FIG. 1

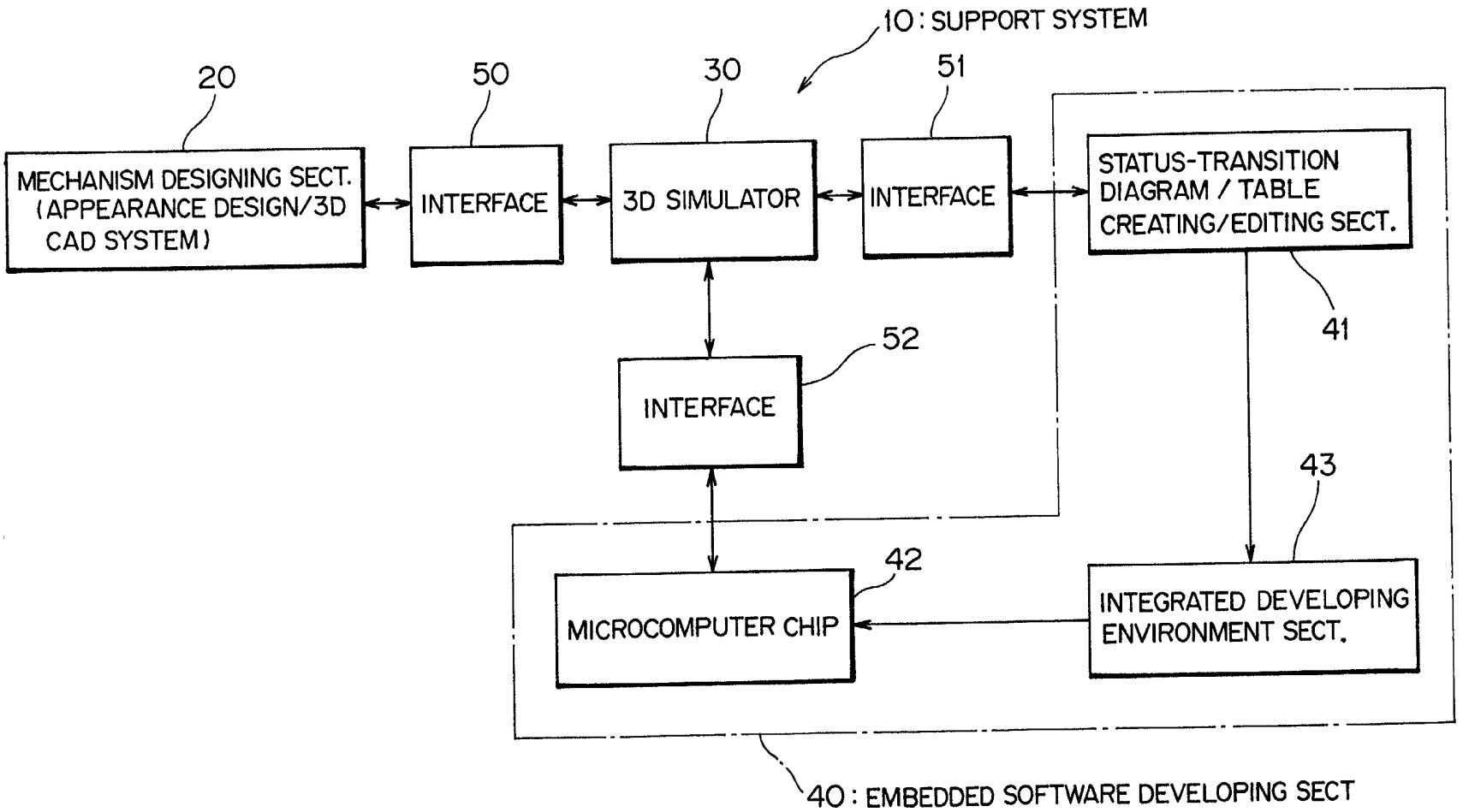


FIG. 2

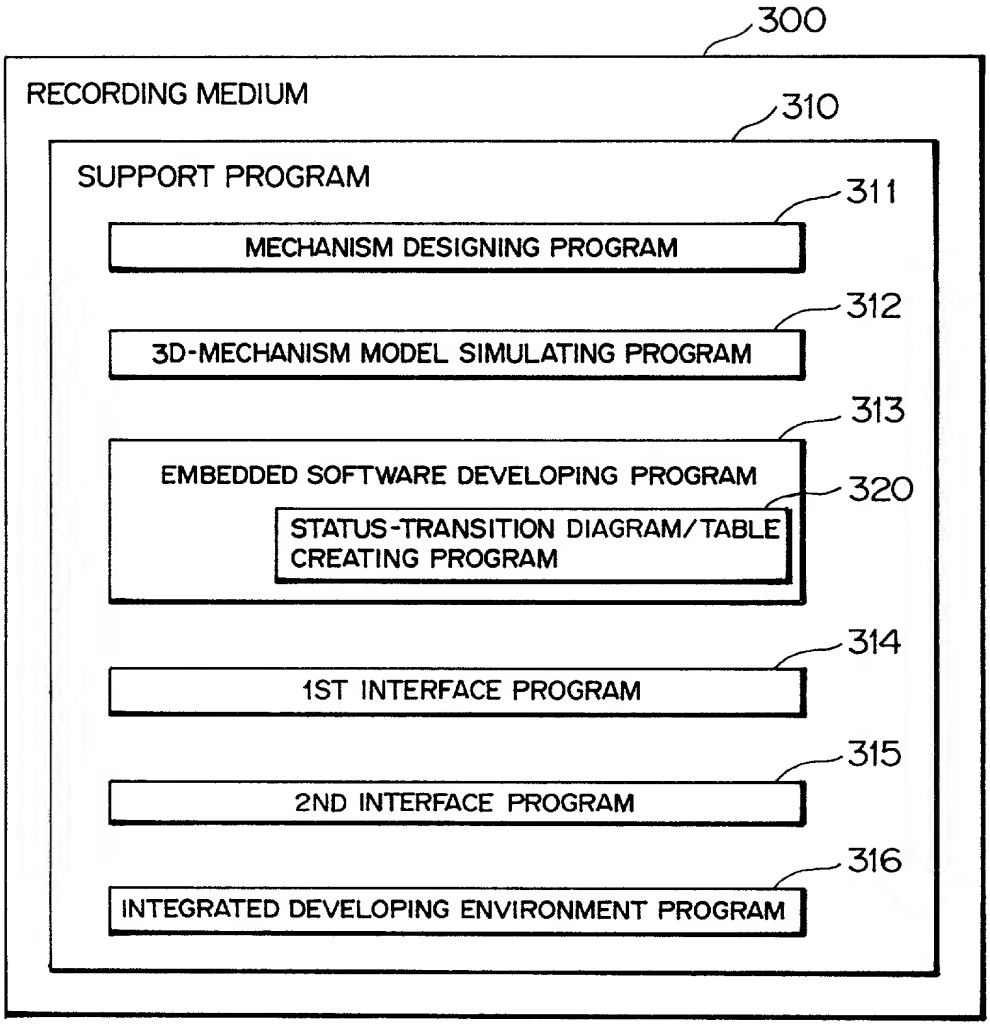

300
RECORDING MEDIUM
310
SUPPORT PROGRAM
311
MECHANISM DESIGNING PROGRAM
312
3D-MECHANISM MODEL SIMULATING PROGRAM
313
EMBEDDED SOFTWARE DEVELOPING PROGRAM
320
STATUS-TRANSITION DIAGRAM/TABLE CREATING PROGRAM
314
1ST INTERFACE PROGRAM
315
2ND INTERFACE PROGRAM
316
INTEGRATED DEVELOPING ENVIRONMENT PROGRAM

FIG. 3

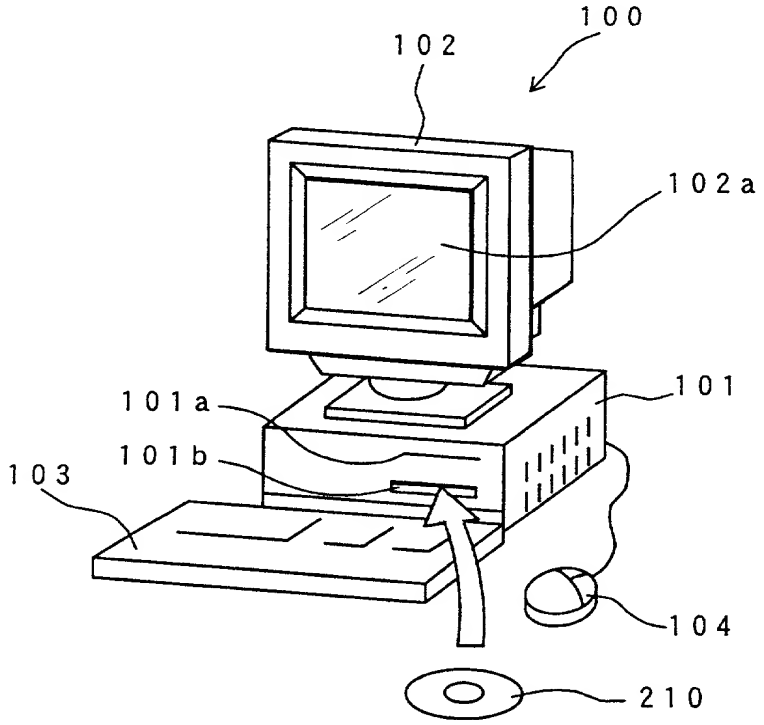


FIG. 4

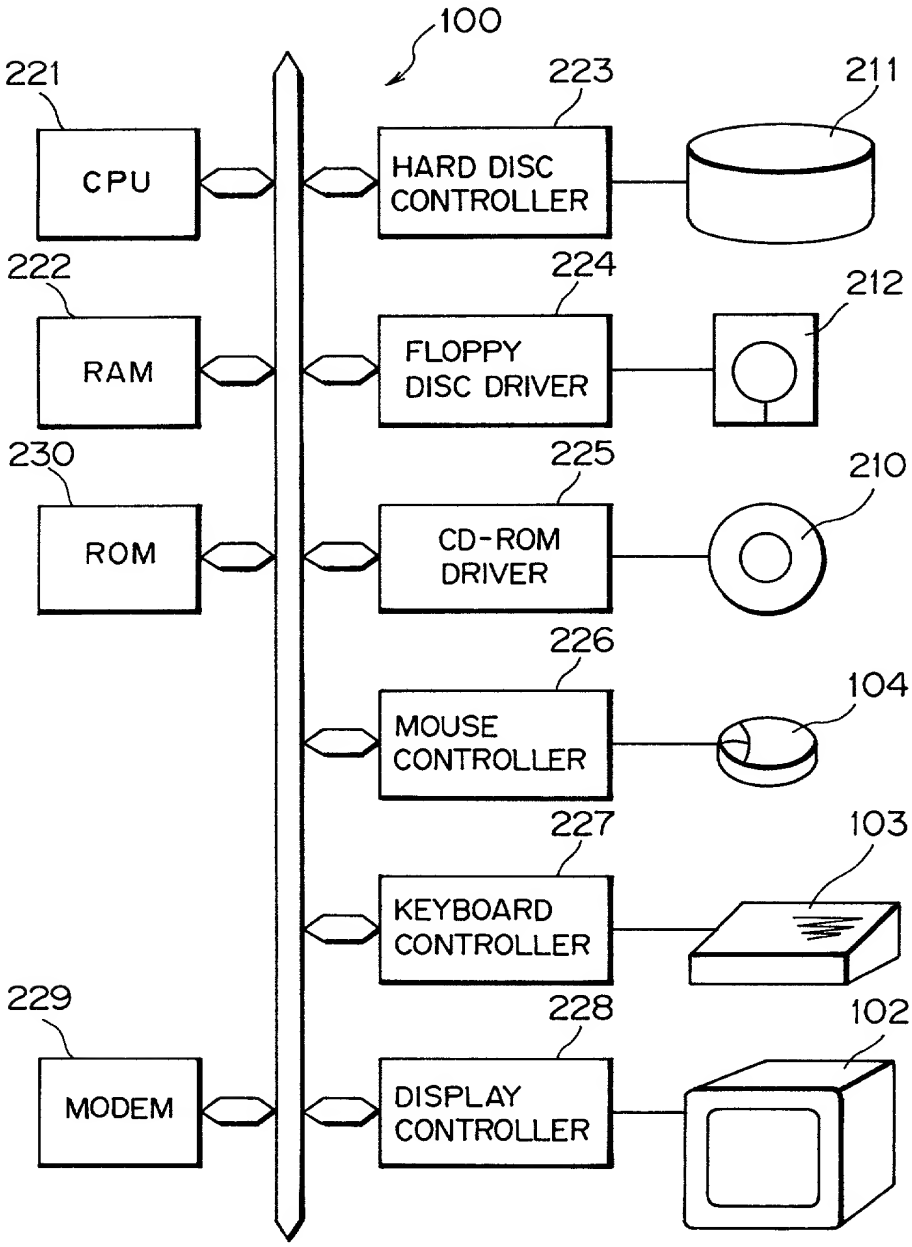

100
221
CPU
222
RAM
230
ROM
229
MODEM
223
HARD DISC CONTROLLER
224
FLOPPY DISC DRIVER
225
CD-ROM DRIVER
226
MOUSE CONTROLLER
227
KEYBOARD CONTROLLER
228
DISPLAY CONTROLLER
211
212
210
104
103
102

FIG. 5

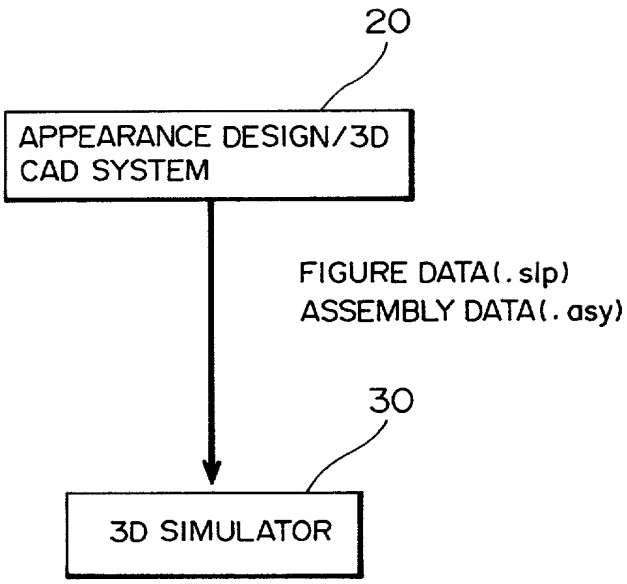

20
APPEARANCE DESIGN/3D CAD SYSTEM
FIGURE DATA(.slp)
ASSEMBLY DATA(.asy)
30
3D SIMULATOR

FIG. 6A

```
SOLID KAM_VERSION2_0_LIBRARY1
  COLOR 1.000000 0.660000 0.000000
  FACET
     NORMAL 0.000000 0.952236 -0.305364
     NORMAL 0.000000 0.952236 -0.305364
     NORMAL 0.000000 0.952236 -0.305364
    OUTER LOOP
     VERTEX 46.667969 -54.467480 -31.538586
     VERTEX 46.667969 -57.256718 -40.236450
     VERTEX 16.667969 -57.256718 -40.236450
    ENDLOOP
  ENDFACET
  FACET
     NORMAL 0.000000 0.952236 -0.305364
     NORMAL 0.000000 0.952236 -0.305364
     NORMAL 0.000000 0.952236 -0.305364
    OUTER LOOP
     VERTEX 16.667969 -57.256718 -40.236450
     VERTEX 16.667969 -54.467480 -31.538586
     VERTEX 46.667969 -54.467480 -31.538586
    ENDLOOP
   ENDACET
.
.
.
  FACET
     NORMAL 0.000000  -0.472754 0.881194
     NORMAL 0.000000  -0.472754 0.881194
     NORMAL 0.000000  -0.472754 0.881194
   OUTER LOOP
     VERTEX 91.667969 -77.803757 -26.071329
     VERTEX 91.667969 -73.224937 -23.614828
     VERTEX 46.667969 -73.224937 -23.614828
    ENDLOOP
  ENDFACET
 ENDSOLID KAM_VERSION2_0_LOBRARY1
```

FIG. 6B

```
BEGIN SPACE
# NO 1
 PARENT 0 # ROOT
 JOINTTYPE FREE
END

 BEGIN "SEAT_ASSY_0_LIBRARY1"
 # NO 2
 PARENT 1 # SPACE
 RELPOSITION 0.000000 0.000000 0.000000
 RELATTITUDE 1.000000 0.000000 0.000000 0.000000
1.000000 0.000000 0.000000 0.000000 1.000000
 JOINTTYPE FIXED
END

BEGIN "SEAT_PAN_0_LIBRARY1"
 # NO 3
 PARENT 2 # SEAT_ASSY_0_LIBRARY1
 SHAPE SEAT_PAN_0_LIBRARY1.SLP
 RELPOSITION 1.810953 51.404652 450.053009
 RELATTITUDE 1.000000 0.000000 0.000000 0.000000
1.000000 0.000000 0.000000 0.000000 1.000000
 JOINTTYPE FIXED
END

BEGIN "KAM_VERSION2_0_LIBRARY1"
 # NO 4
 PARENT 2 # SEAT_ASSY_0_LIBRARY1
 SHAPE KAM_VERSION2_0_LIBRARY1.SLP
 RELPOSITION 201.712204 -211.475098 811.809509
 RELATTITUDE 0.104385 0.034423 -0.993941 0.994522
-0.009110 0.104131 -0.005471 -0.999366 -0.035185
 JOINTTYPE FIXED
END
.
.
.
```

FIG. 7

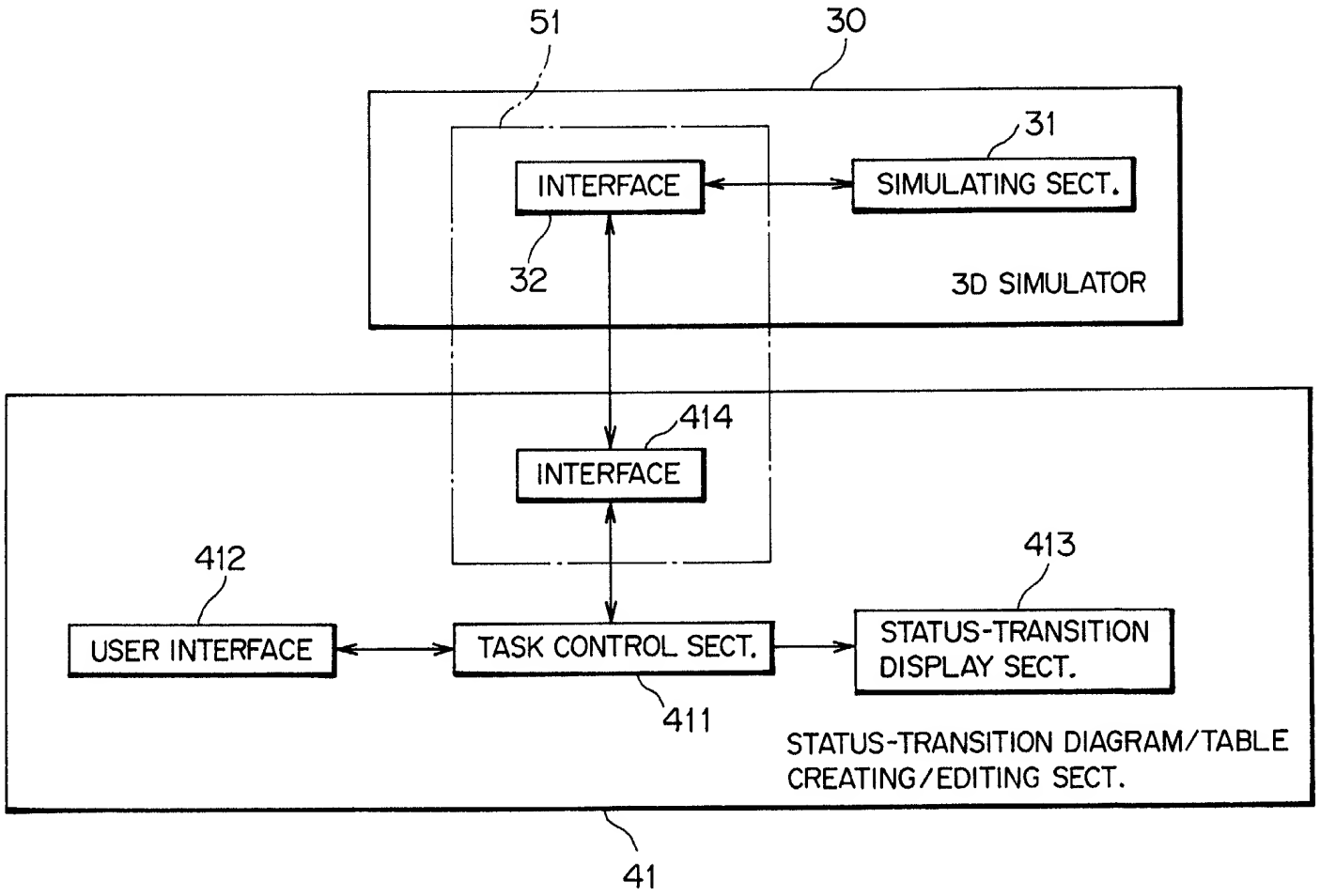


FIG. 8

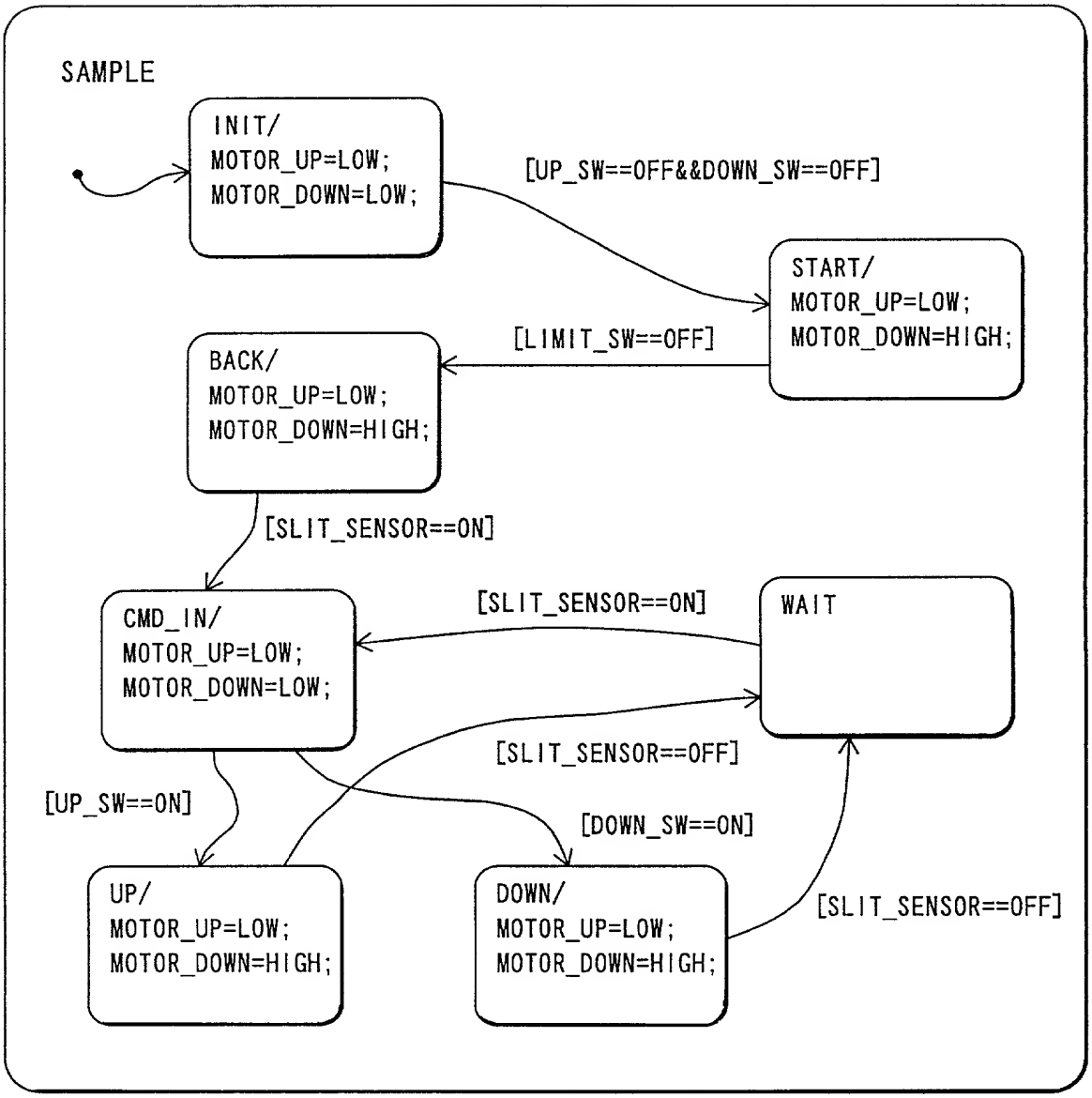

SAMPLE
INIT/
MOTOR_UP=LOW;
MOTOR_DOWN=LOW;
[UP_SW==OFF&&DOWN_SW==OFF]
START/
MOTOR_UP=LOW;
MOTOR_DOWN=HIGH;
[LIMIT_SW==OFF]
BACK/
MOTOR_UP=LOW;
MOTOR_DOWN=HIGH;
[SLIT_SENSOR==ON]
CMD_IN/
MOTOR_UP=LOW;
MOTOR_DOWN=LOW;
[SLIT_SENSOR==ON]
WAIT
[SLIT_SENSOR==OFF]
[UP_SW==ON]
[DOWN_SW==ON]
UP/
MOTOR_UP=LOW;
MOTOR_DOWN=HIGH;
DOWN/
MOTOR_UP=LOW;
MOTOR_DOWN=HIGH;
[SLIT_SENSOR==OFF]

FIG. 9

		STOPPING	RUNNING STRAIGHT	CORNERING LEFT	CORNERING RIGHT
	E \ S	0	1	2	3
SIGNAL_BLUE	0	1 ACCELE ON ( );	– /	– /	– /
LEFT CURVE	1	– /	2 ACCELE OFF ( ); TURN LEFT ( );	– TURN LEFT ( );	2 TURN LEFT ( );
RIGHT CURVE	2	– /	3 ACCELE OFF ( ); TURN RIGHT ( );	3 TURN RIGHT ( );	3 TURN RIGHT ( );
STRAIGHT	3	– /	– /	1 STEERING BACK ( ); ACCELE ON ( );	1 STEERING BACK ( ); ACCELE ON ( );

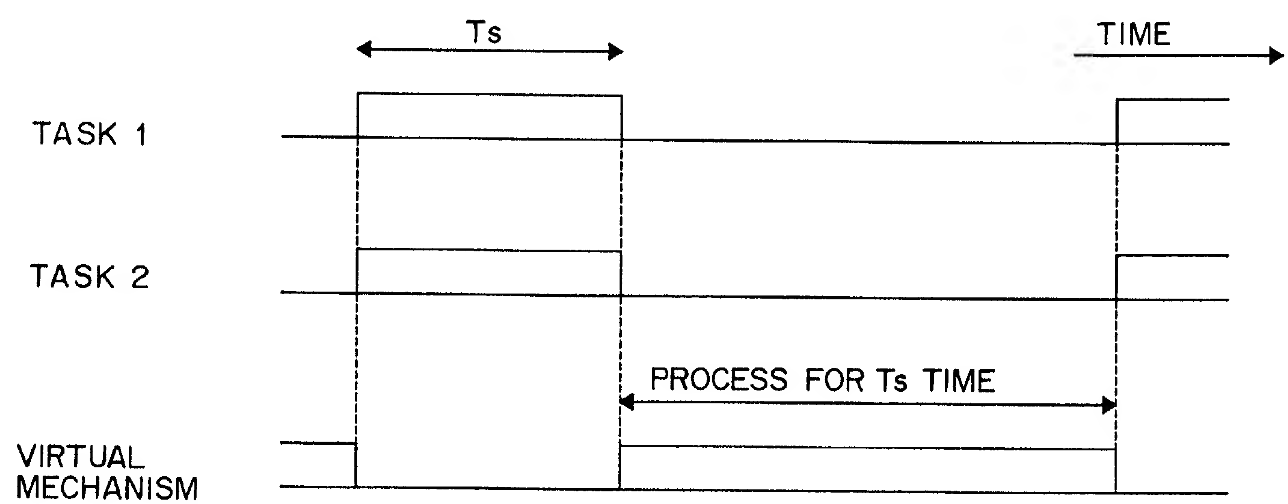


FIG. 10A

FIG. 10B

FIG. 10C

FIG. 11A

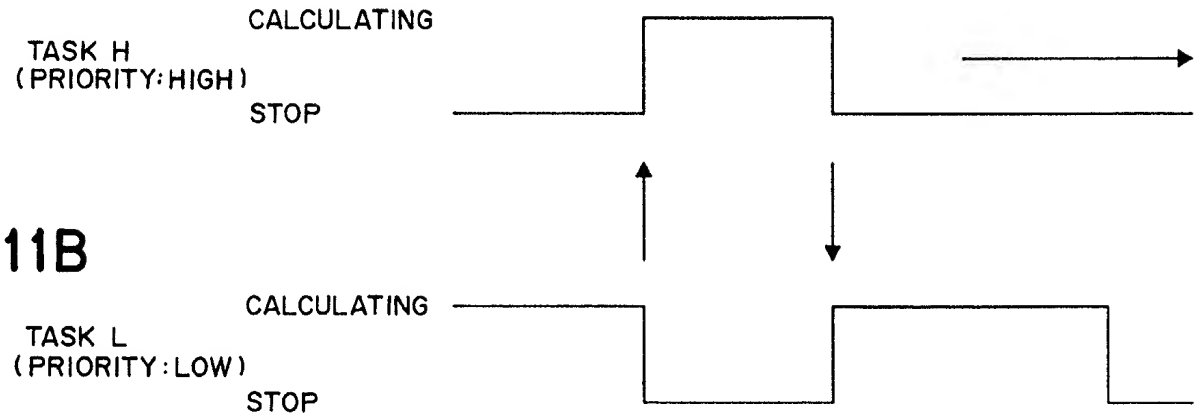


FIG. 11B

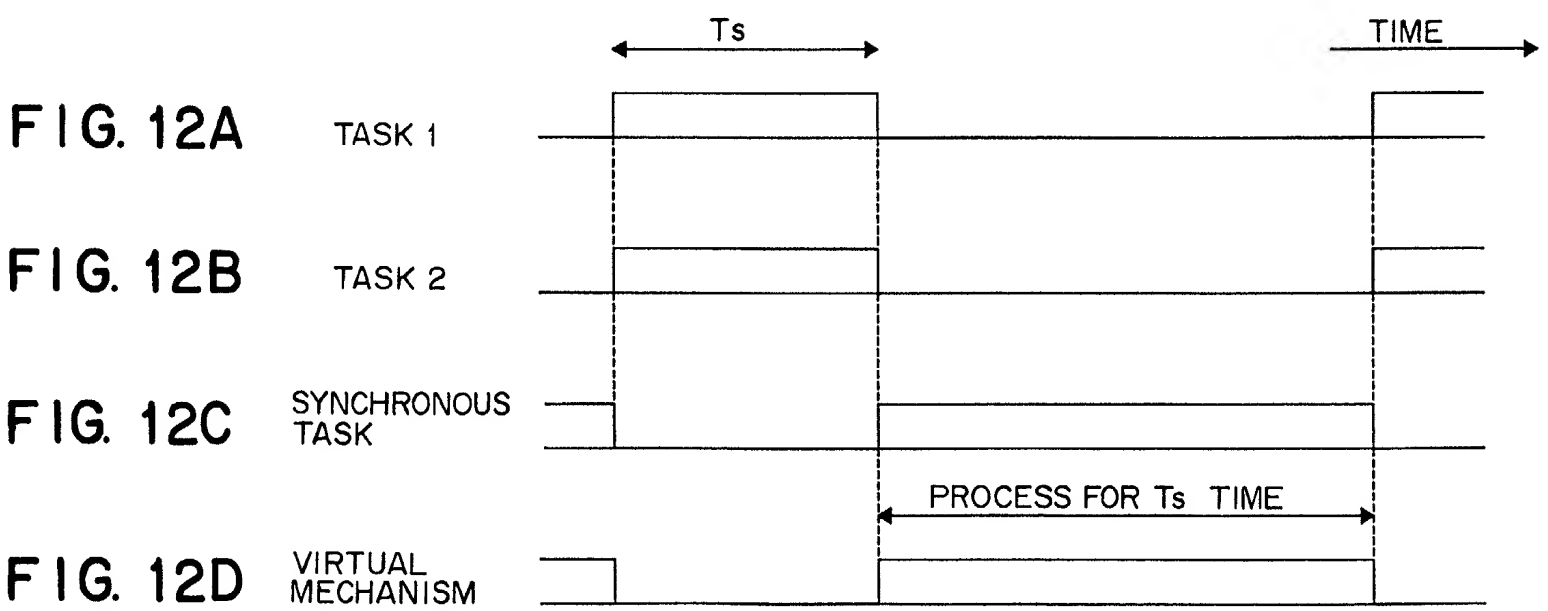


FIG. 12A

FIG. 12B

FIG. 12C

FIG. 12D

FIG. 13

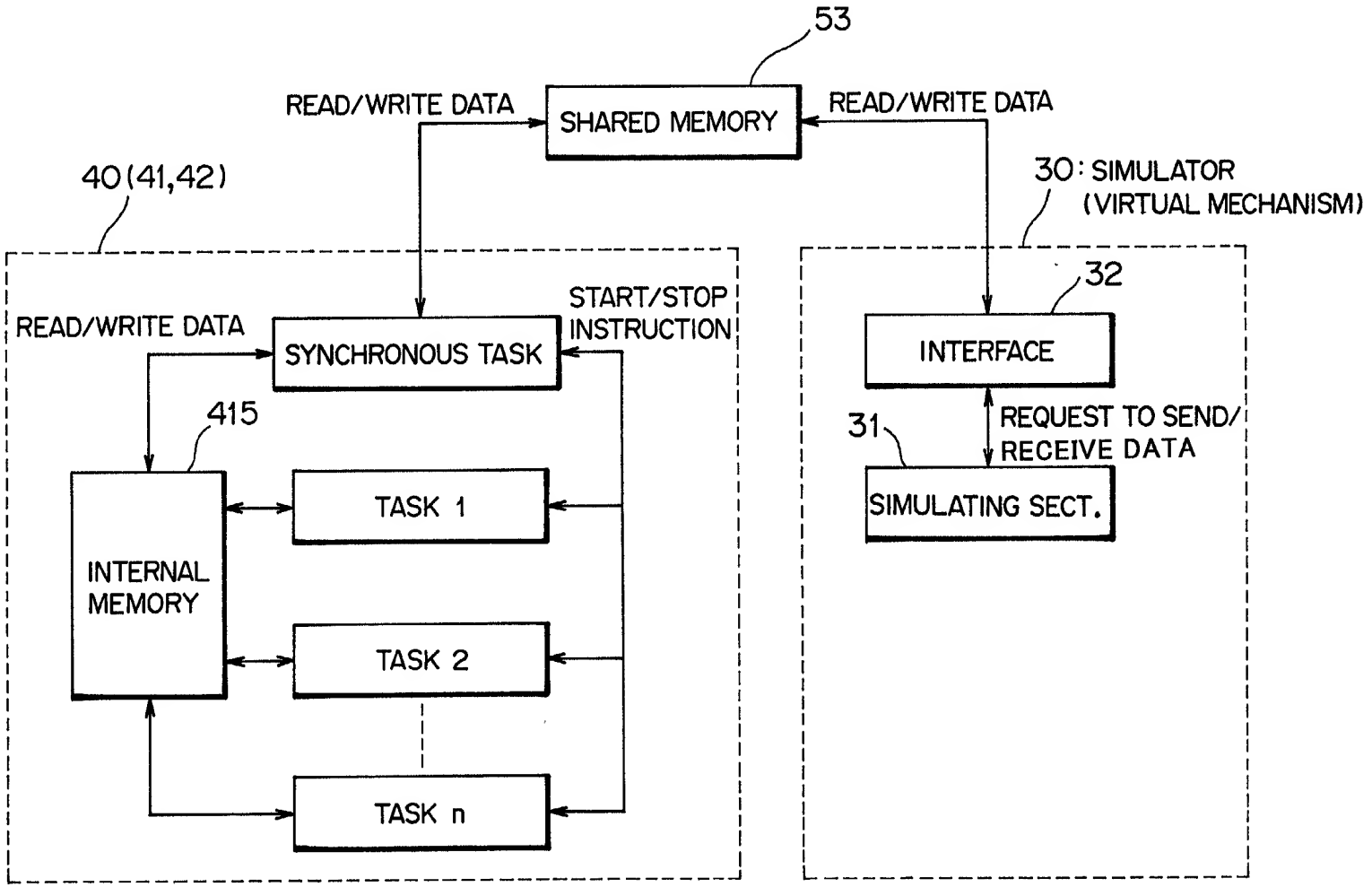

53
READ/WRITE DATA
SHARED MEMORY
READ/WRITE DATA
40(41,42)
30: SIMULATOR
(VIRTUAL MECHANISM)
32
START/STOP
INSTRUCTION
READ/WRITE DATA
SYNCHRONOUS TASK
INTERFACE
415
31
REQUEST TO SEND/
RECEIVE DATA
TASK 1
INTERNAL
MEMORY
SIMULATING SECT.
TASK 2
TASK n

FIG. 14

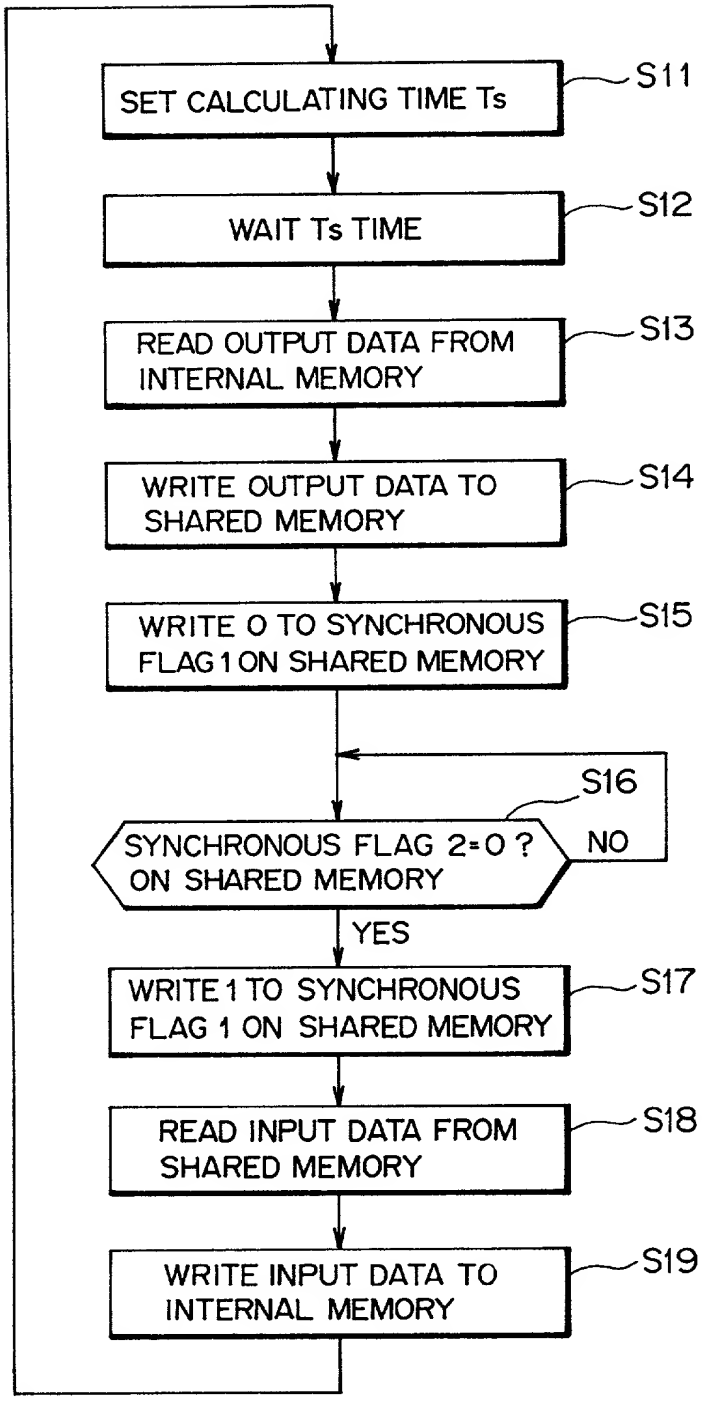

SET CALCULATING TIME Ts
S11
WAIT Ts TIME
S12
READ OUTPUT DATA FROM INTERNAL MEMORY
S13
WRITE OUTPUT DATA TO SHARED MEMORY
S14
WRITE 0 TO SYNCHRONOUS FLAG 1 ON SHARED MEMORY
S15
S16
SYNCHRONOUS FLAG 2=0 ? ON SHARED MEMORY
NO
YES
WRITE 1 TO SYNCHRONOUS FLAG 1 ON SHARED MEMORY
S17
READ INPUT DATA FROM SHARED MEMORY
S18
WRITE INPUT DATA TO INTERNAL MEMORY
S19

FIG. 15

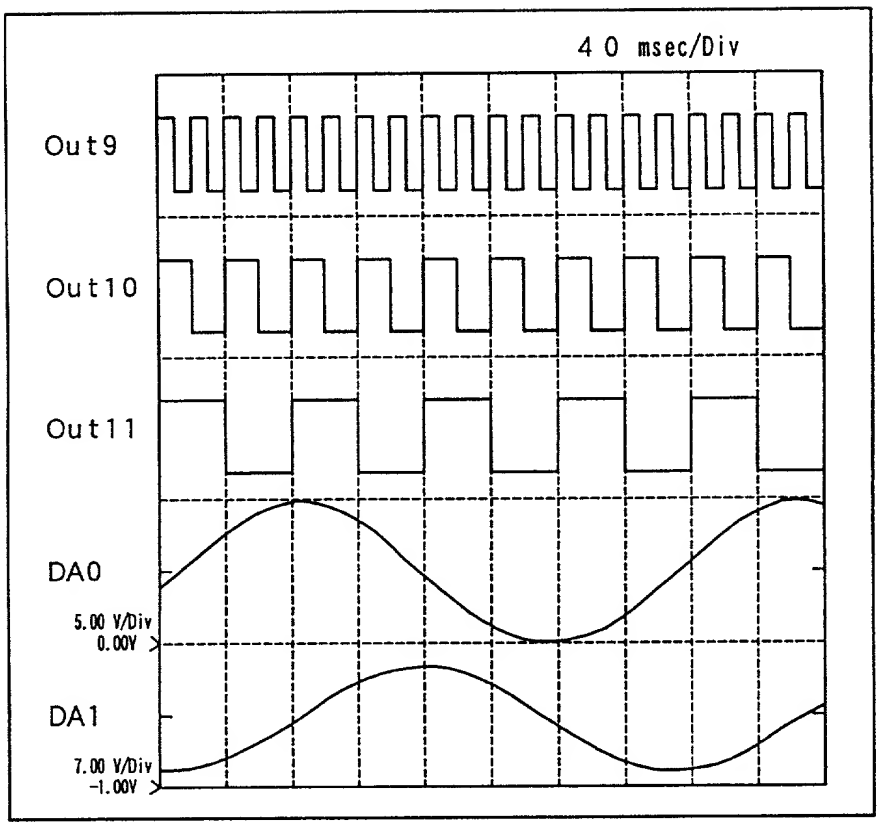

40 msec/Div
Out9
Out10
Out11
DA0
5.00 V/Div
0.00V
DA1
7.00 V/Div
-1.00V

FIG. 16

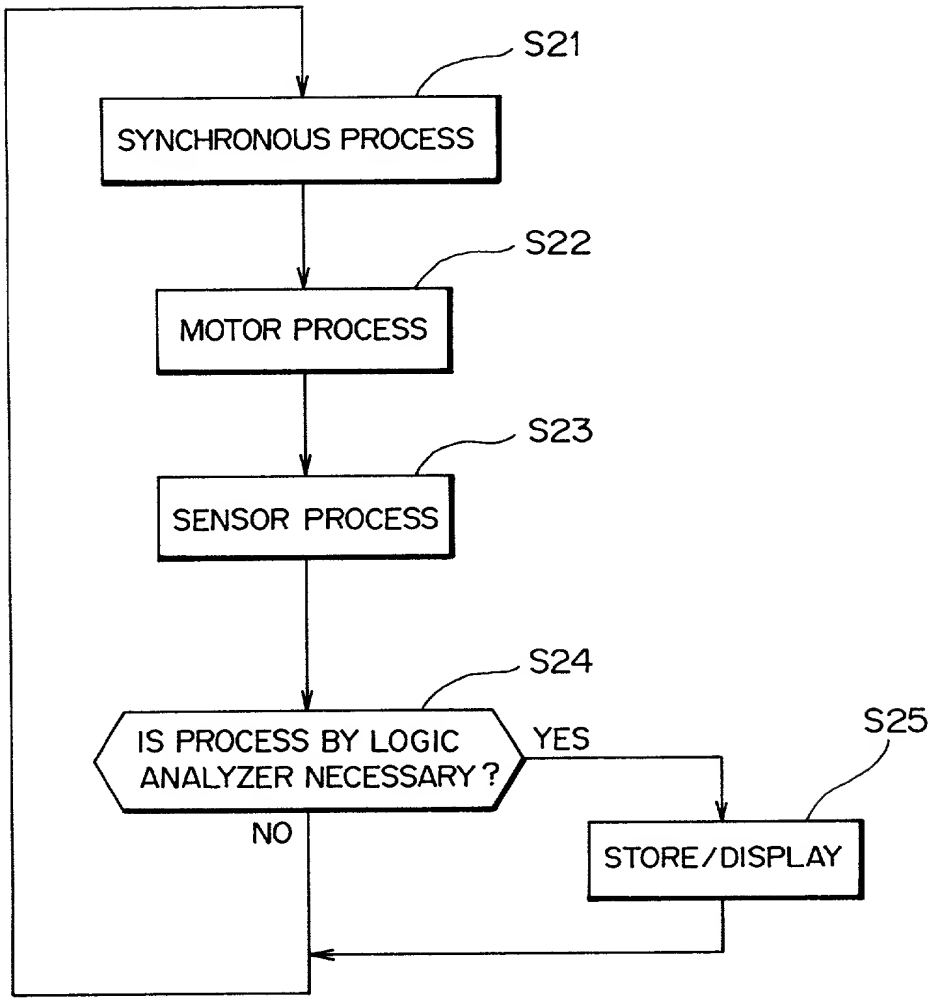

S21
SYNCHRONOUS PROCESS
S22
MOTOR PROCESS
S23
SENSOR PROCESS
S24
IS PROCESS BY LOGIC ANALYZER NECESSARY ?
YES
NO
S25
STORE/DISPLAY

FIG. 17

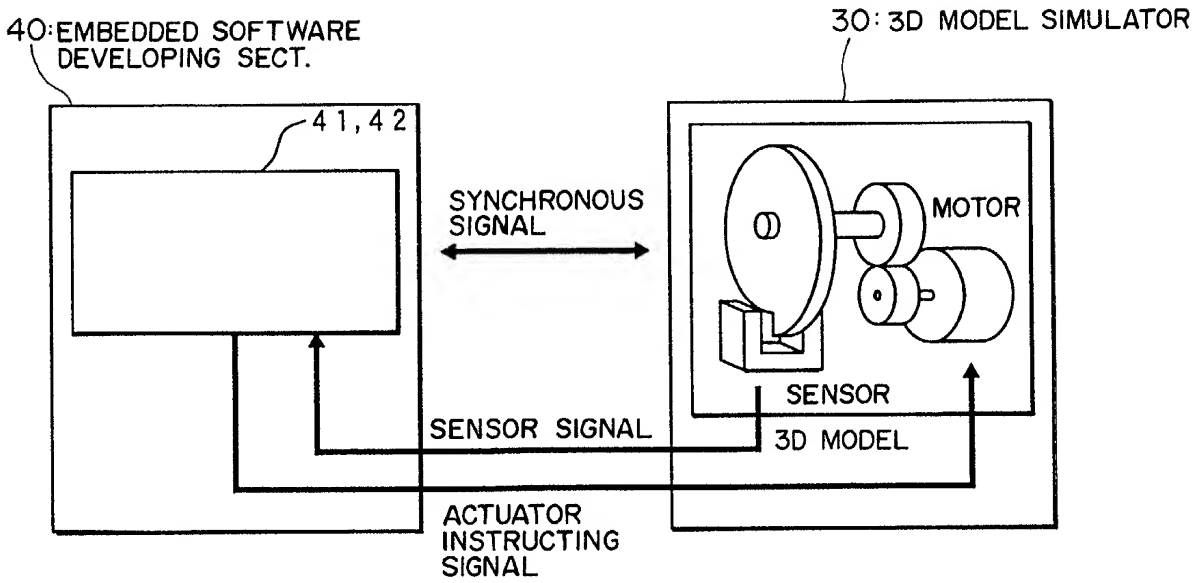

40: EMBEDDED SOFTWARE DEVELOPING SECT.
41, 42
30: 3D MODEL SIMULATOR
SYNCHRONOUS SIGNAL
MOTOR
SENSOR
SENSOR SIGNAL
3D MODEL
ACTUATOR INSTRUCTING SIGNAL

FIG. 18

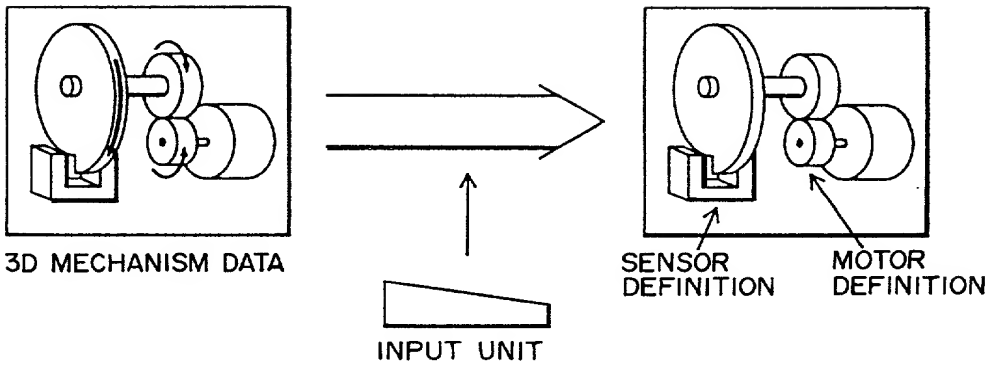

3D MECHANISM DATA
INPUT UNIT
SENSOR DEFINITION
MOTOR DEFINITION

FIG. 19

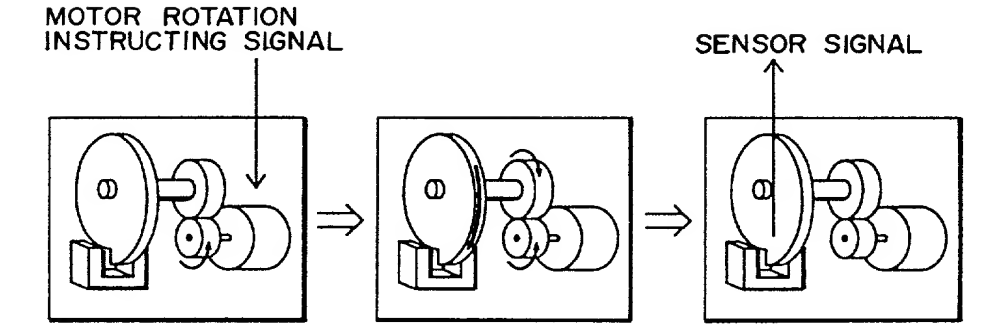
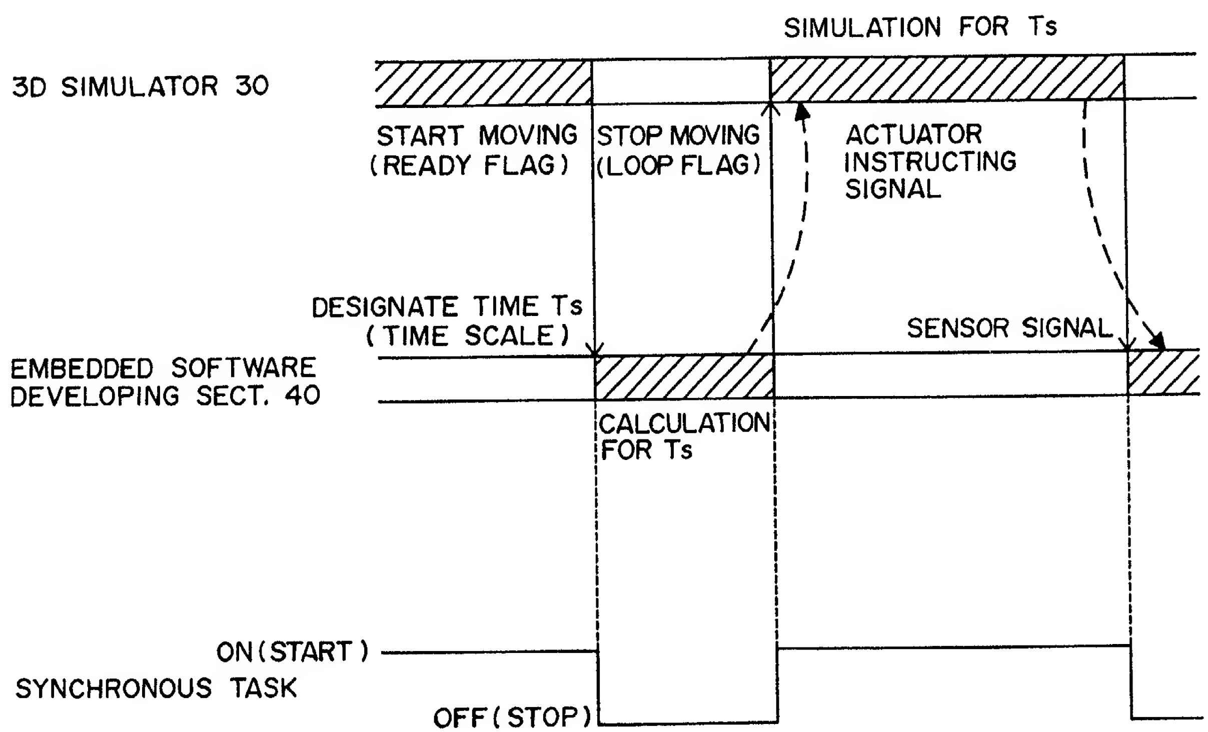

MOTOR ROTATION INSTRUCTING SIGNAL
SENSOR SIGNAL
MOTOR IS ROTATED BY MOTOR ROTATION INSTRUCTING SIGNAL
VARIOUS PARTS ARE MOVED BASED ON MECHANISM DATA
SENSOR SIGNAL IS OUTPUT WITH LINK DEFINED AS SENSOR

FIG. 20



SIMULATION FOR Ts
3D SIMULATOR 30
START MOVING
(READY FLAG)
STOP MOVING
(LOOP FLAG)
ACTUATOR
INSTRUCTING
SIGNAL
DESIGNATE TIME Ts
(TIME SCALE)
SENSOR SIGNAL
EMBEDDED SOFTWARE
DEVELOPING SECT. 40
CALCULATION
FOR Ts
ON (START)
SYNCHRONOUS TASK
OFF (STOP)

FIG. 21

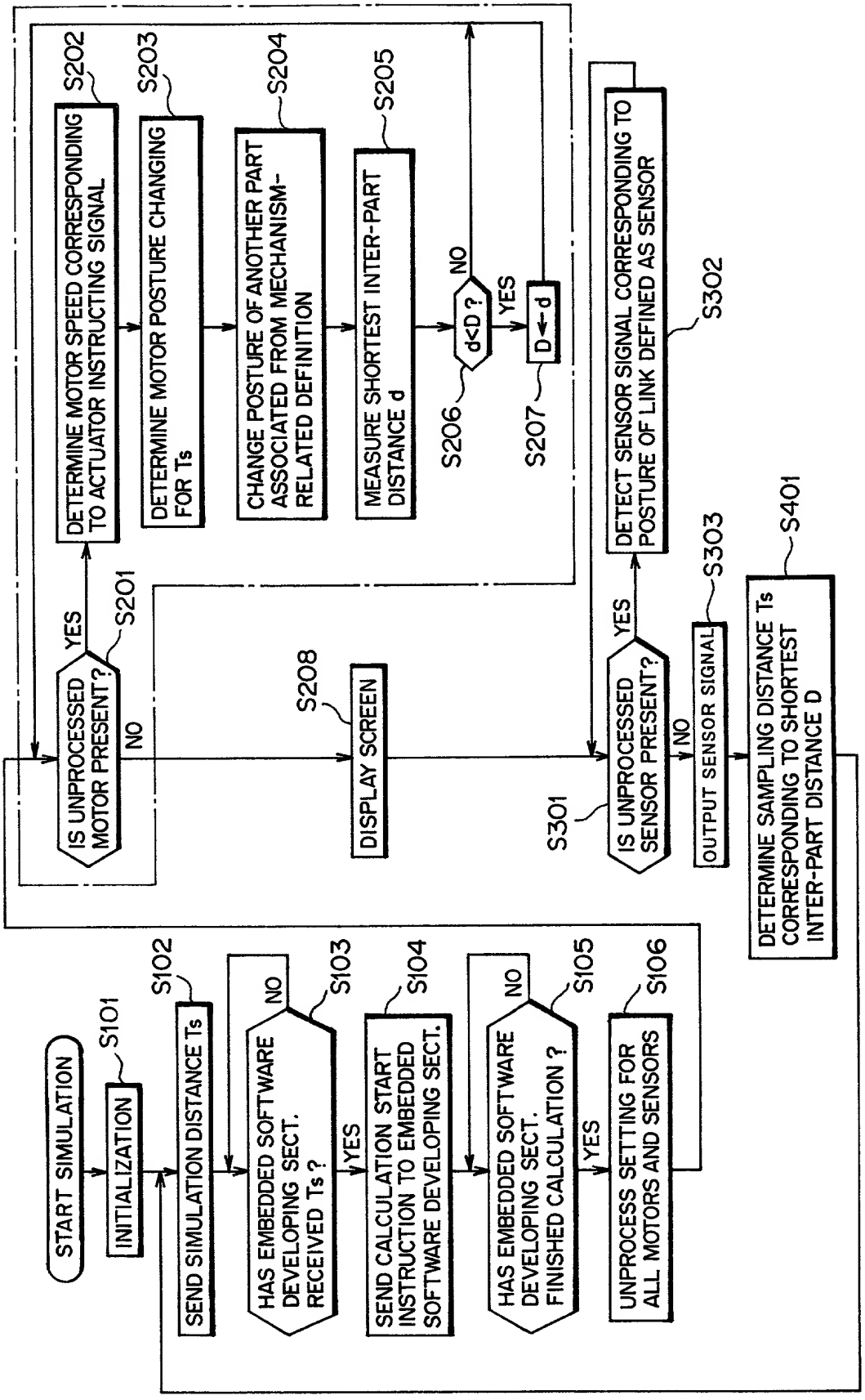

START SIMULATION
S101
INITIALIZATION
S102
SEND SIMULATION DISTANCE Ts
S103
HAS EMBEDDED SOFTWARE DEVELOPING SECT. RECEIVED Ts ?
NO
YES
S104
SEND CALCULATION START INSTRUCTION TO EMBEDDED SOFTWARE DEVELOPING SECT.
S105
HAS EMBEDDED SOFTWARE DEVELOPING SECT. FINISHED CALCULATION ?
NO
YES
S106
UNPROCESS SETTING FOR ALL MOTORS AND SENSORS
S201
IS UNPROCESSED MOTOR PRESENT?
YES
NO
S202
DETERMINE MOTOR SPEED CORRESPONDING TO ACTUATOR INSTRUCTING SIGNAL
S203
DETERMINE MOTOR POSTURE CHANGING FOR Ts
S204
CHANGE POSTURE OF ANOTHER PART ASSOCIATED FROM MECHANISM-RELATED DEFINITION
S205
MEASURE SHORTEST INTER-PART DISTANCE d
S206
d<D ?
NO
YES
S207
D←d
S208
DISPLAY SCREEN
S301
IS UNPROCESSED SENSOR PRESENT?
YES
NO
S302
DETECT SENSOR SIGNAL CORRESPONDING TO POSTURE OF LINK DEFINED AS SENSOR
S303
OUTPUT SENSOR SIGNAL
S401
DETERMINE SAMPLING DISTANCE Ts CORRESPONDING TO SHORTEST INTER-PART DISTANCE D

FIG. 22

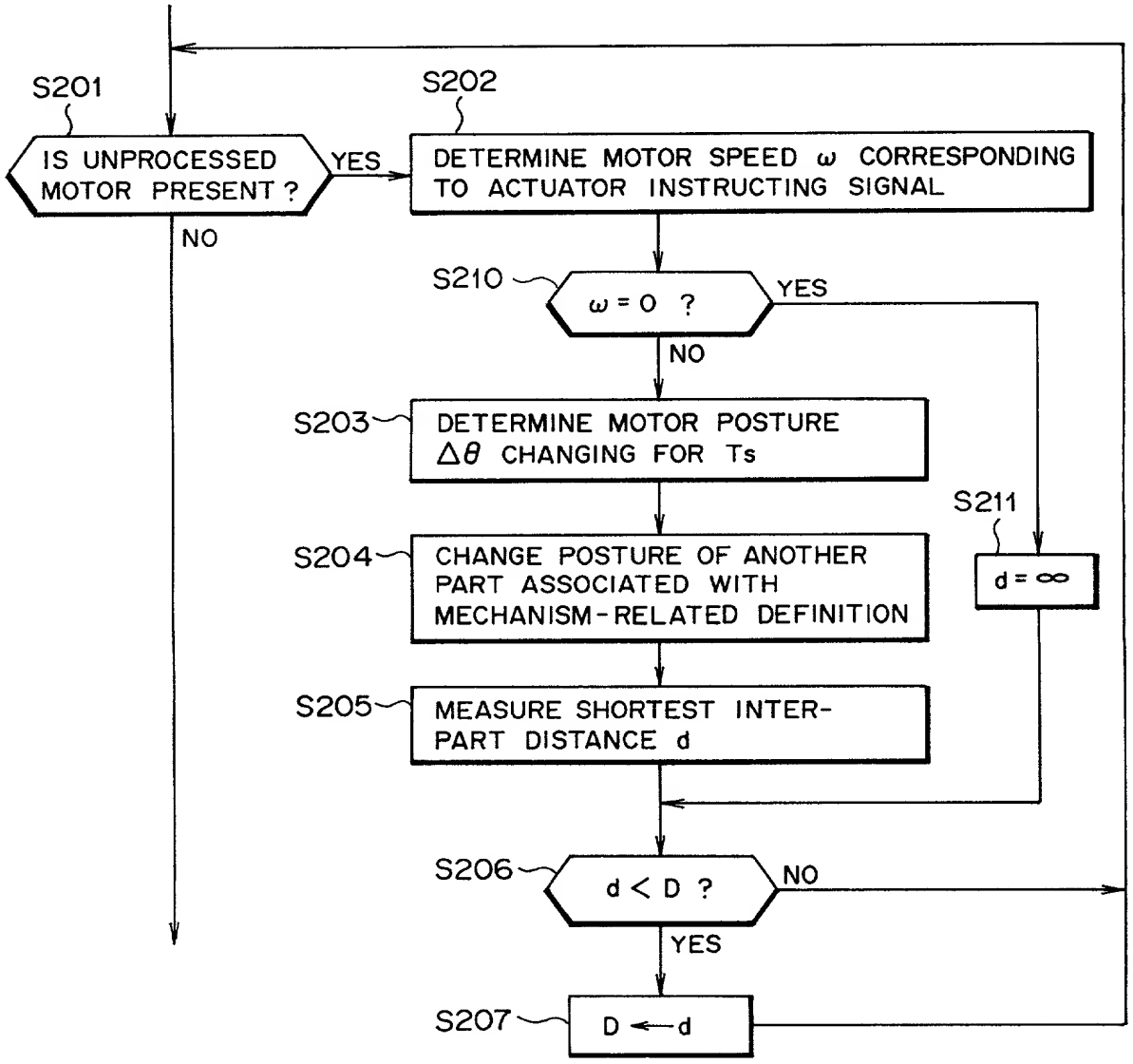

S201
IS UNPROCESSED MOTOR PRESENT ?
YES
NO
S202
DETERMINE MOTOR SPEED ω CORRESPONDING TO ACTUATOR INSTRUCTING SIGNAL
S210
ω = 0 ?
YES
NO
S203
DETERMINE MOTOR POSTURE Δθ CHANGING FOR Ts
S204
CHANGE POSTURE OF ANOTHER PART ASSOCIATED WITH MECHANISM-RELATED DEFINITION
S205
MEASURE SHORTEST INTER-PART DISTANCE d
S211
d = ∞
S206
d < D ?
NO
YES
S207
D ← d

FIG.23

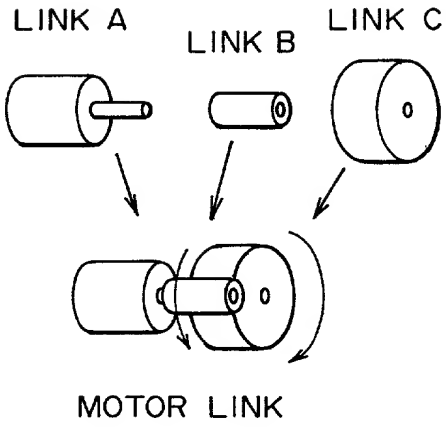


FIG. 24A

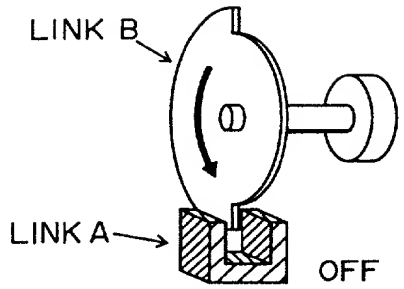


FIG. 24B

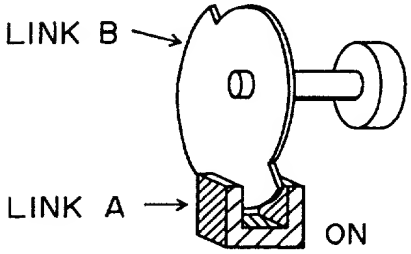


FIG. 25A

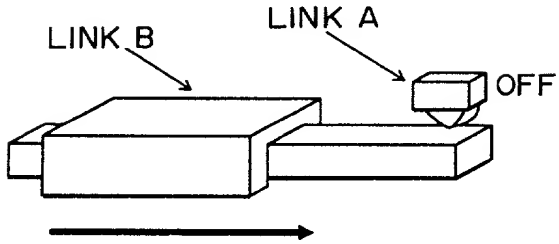


FIG. 25B

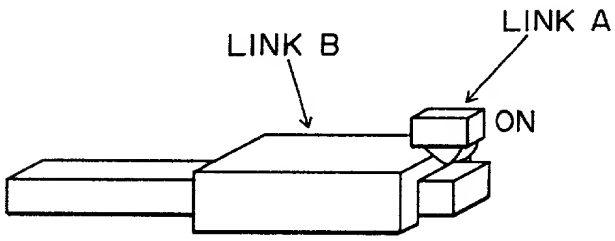


FIG. 26

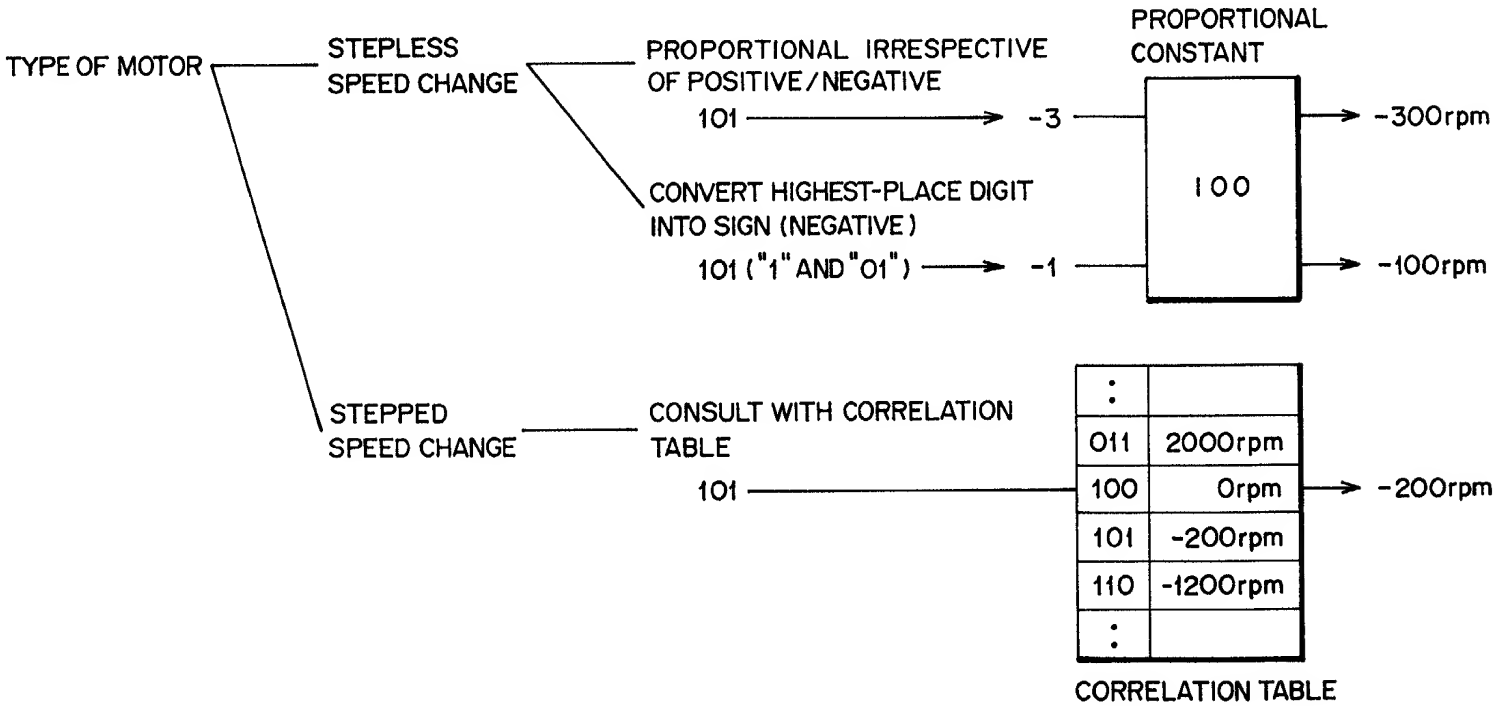

TYPE OF MOTOR
STEPLESS SPEED CHANGE
PROPORTIONAL IRRESPECTIVE OF POSITIVE/NEGATIVE
101
-3
PROPORTIONAL CONSTANT
100
-300rpm
CONVERT HIGHEST-PLACE DIGIT INTO SIGN (NEGATIVE)
101 ("1" AND "01")
-1
-100rpm
STEPPED SPEED CHANGE
CONSULT WITH CORRELATION TABLE
101
011 2000rpm
100 0rpm
101 -200rpm
110 -1200rpm
-200rpm
CORRELATION TABLE

FIG. 27

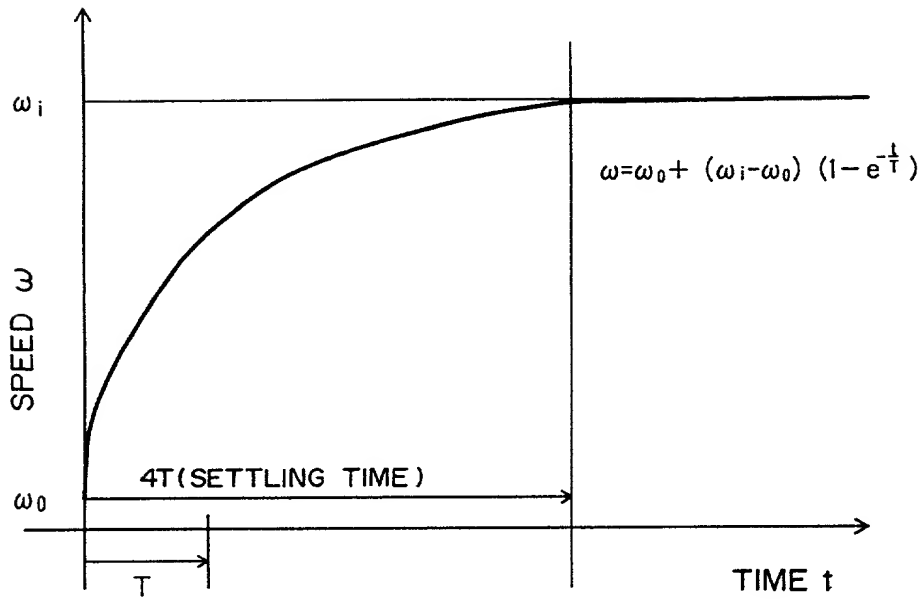

ω_i
ω_0
SPEED ω
$\omega=\omega_0+(\omega_i-\omega_0)(1-e^{-\frac{t}{T}})$
4T(SETTLING TIME)
T
TIME t

FIG. 28

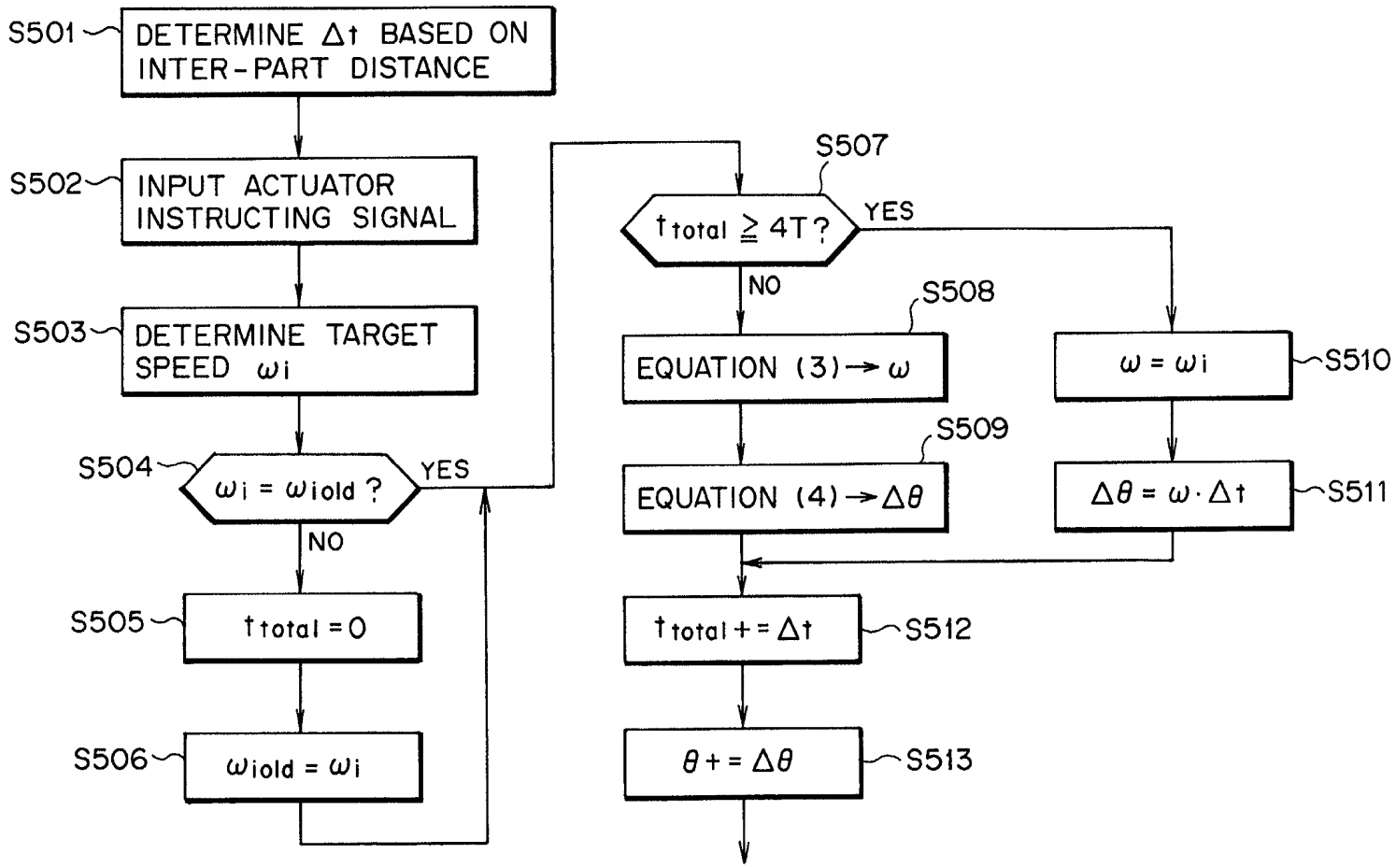

S501
DETERMINE Δt BASED ON INTER-PART DISTANCE
S502
INPUT ACTUATOR INSTRUCTING SIGNAL
S503
DETERMINE TARGET SPEED ωi
S504
ωi = ωiold ?
YES
NO
S505
ttotal = 0
S506
ωiold = ωi
S507
ttotal ≧ 4T ?
YES
NO
S508
EQUATION (3) → ω
S509
EQUATION (4) → Δθ
S510
ω = ωi
S511
Δθ = ω · Δt
S512
ttotal += Δt
S513
θ += Δθ

FIG. 29

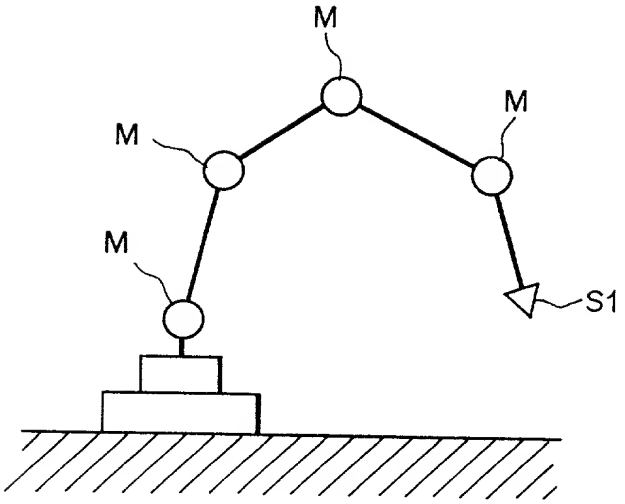


FIG. 30

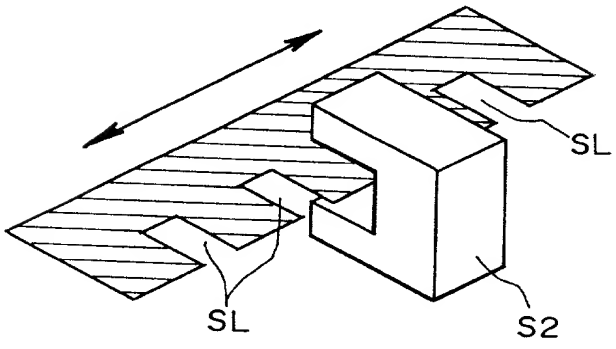


FIG. 31A

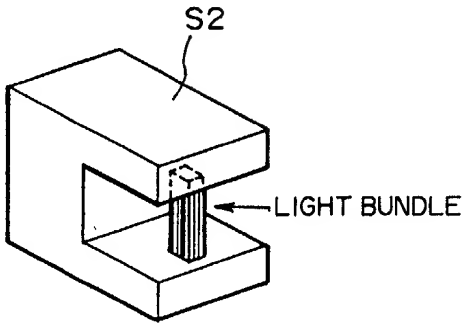


FIG. 31B

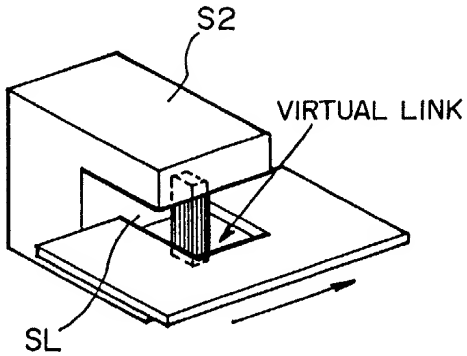


FIG. 31C

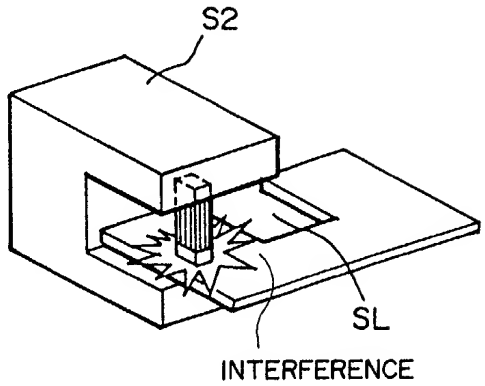


FIG. 32

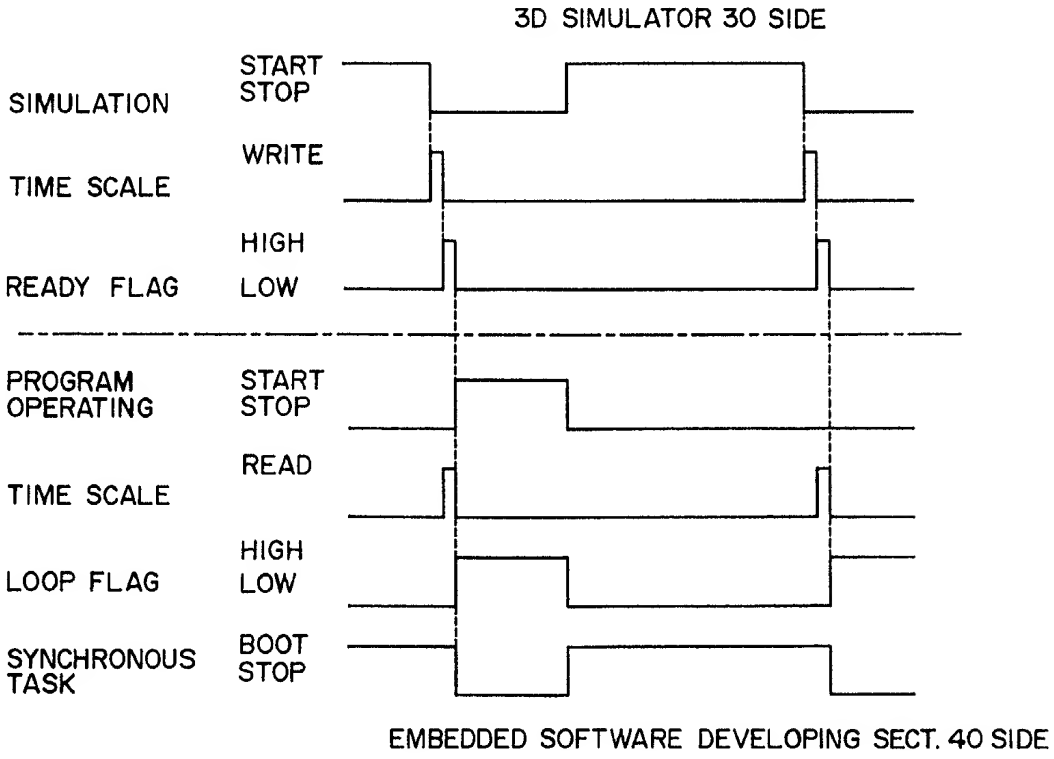

3D SIMULATOR 30 SIDE
SIMULATION
START
STOP
TIME SCALE
WRITE
READY FLAG
HIGH
LOW
PROGRAM OPERATING
START
STOP
TIME SCALE
READ
LOOP FLAG
HIGH
LOW
SYNCHRONOUS TASK
BOOT
STOP
EMBEDDED SOFTWARE DEVELOPING SECT. 40 SIDE

FIG. 33

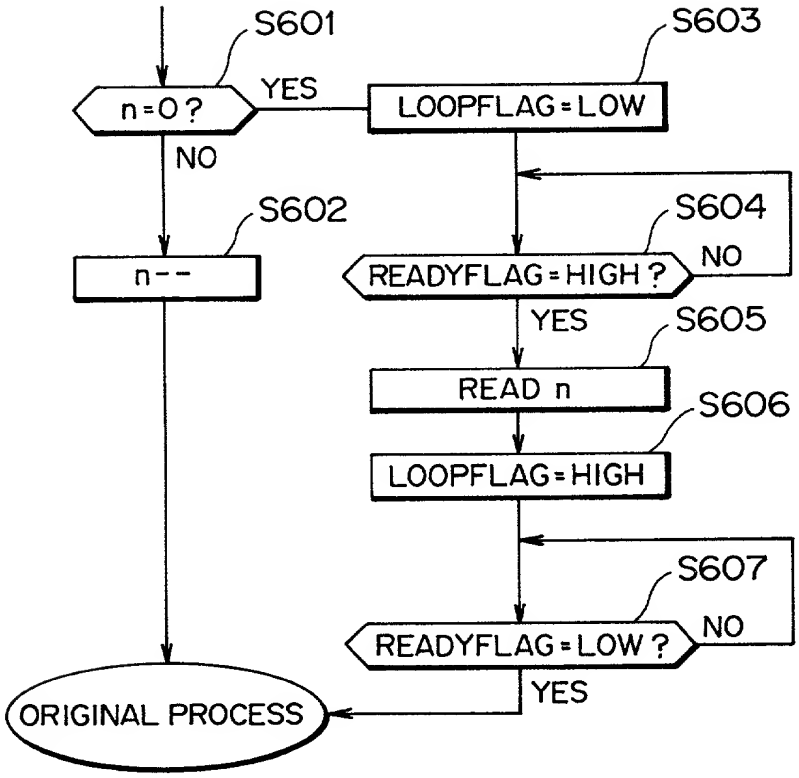

S601
n=0?
YES
NO
S602
n--
S603
LOOPFLAG=LOW
S604
READYFLAG=HIGH?
NO
YES
S605
READ n
S606
LOOPFLAG=HIGH
S607
READYFLAG=LOW?
NO
YES
ORIGINAL PROCESS

FIG. 34

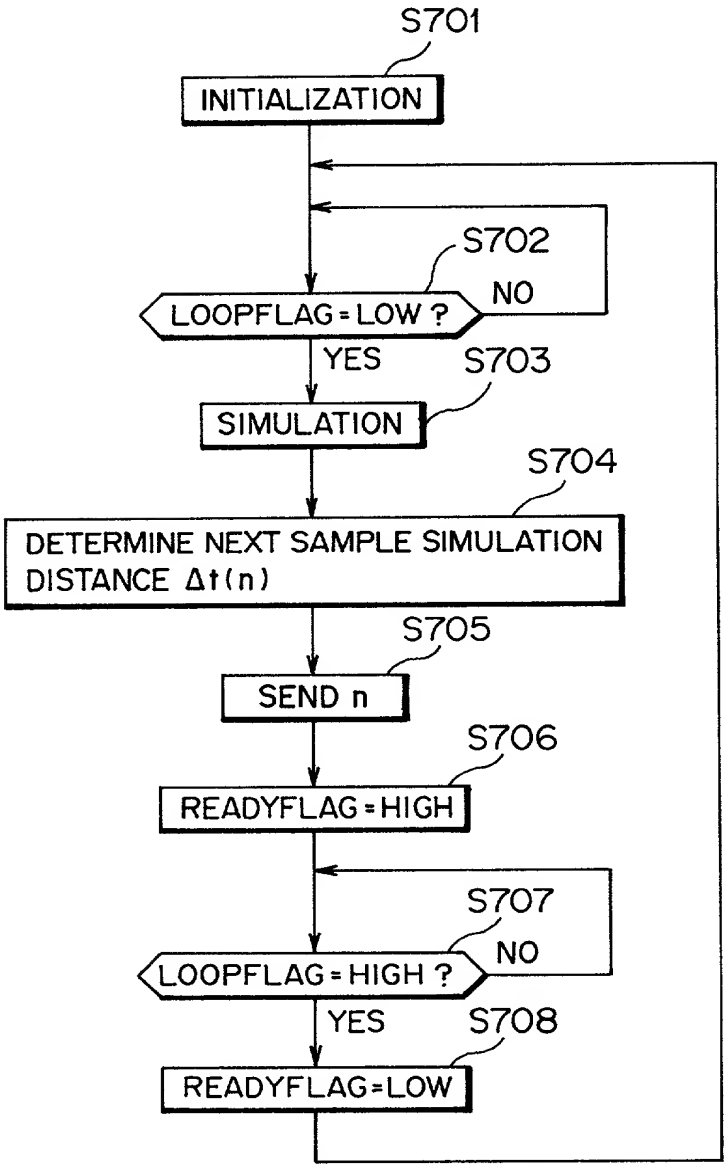

S701
INITIALIZATION
S702
LOOPFLAG = LOW ?
NO
YES
S703
SIMULATION
S704
DETERMINE NEXT SAMPLE SIMULATION DISTANCE Δt(n)
S705
SEND n
S706
READYFLAG = HIGH
S707
LOOPFLAG = HIGH ?
NO
YES
S708
READYFLAG=LOW

FIG. 35A

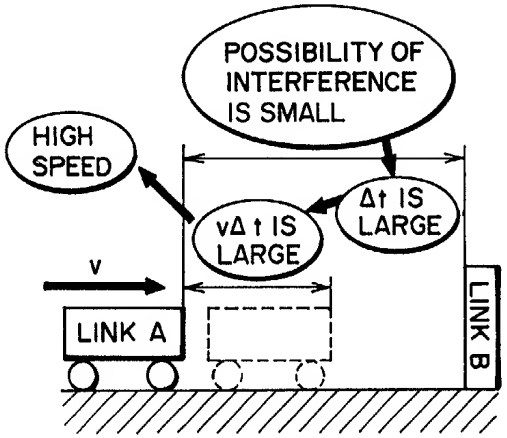


FIG. 35B

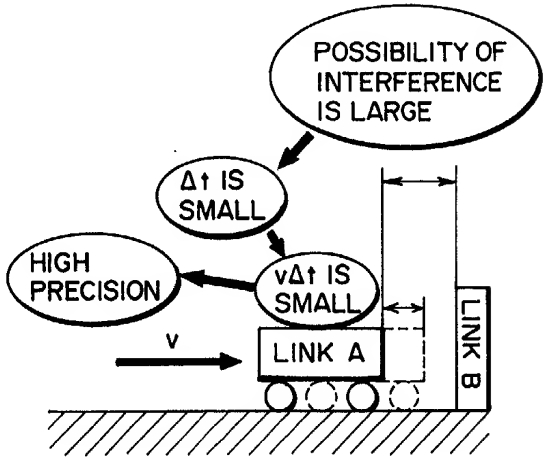


FIG. 36A

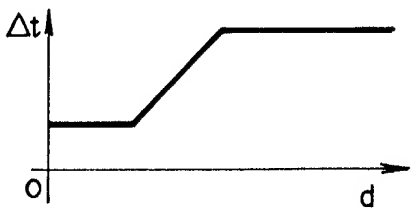


FIG. 36B

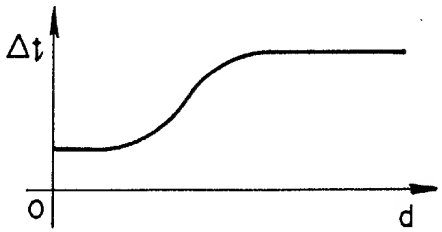


FIG. 36C

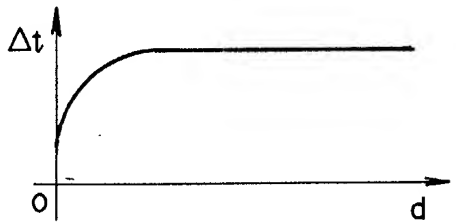


FIG. 37A

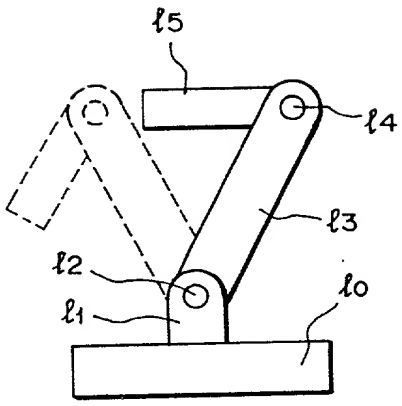


FIG. 37B

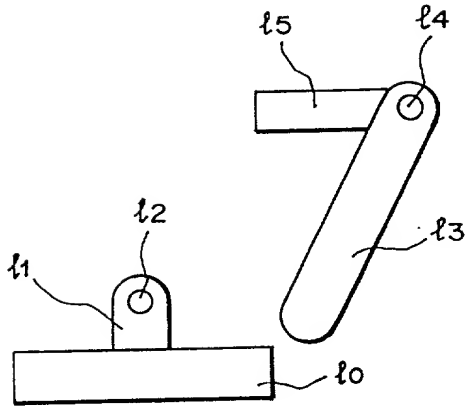


FIG. 38A

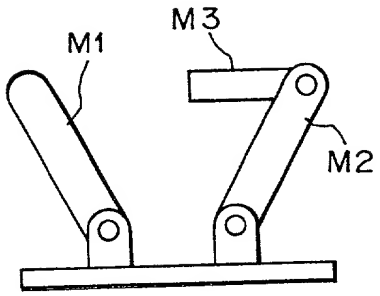


FIG. 38B

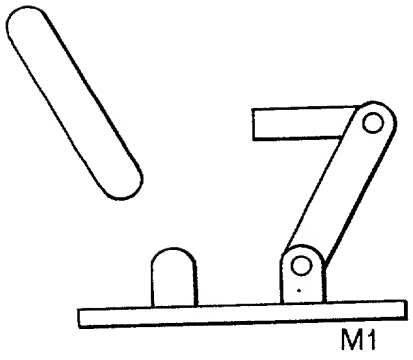


FIG. 38C

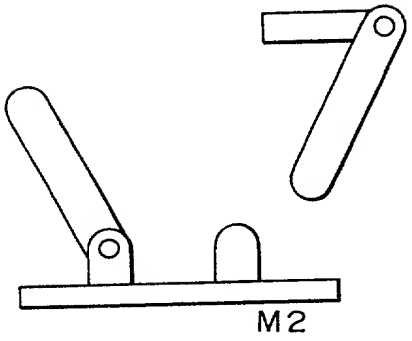


FIG. 38D

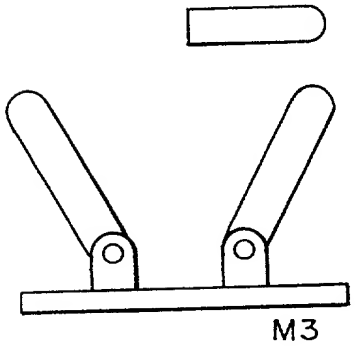


FIG. 39

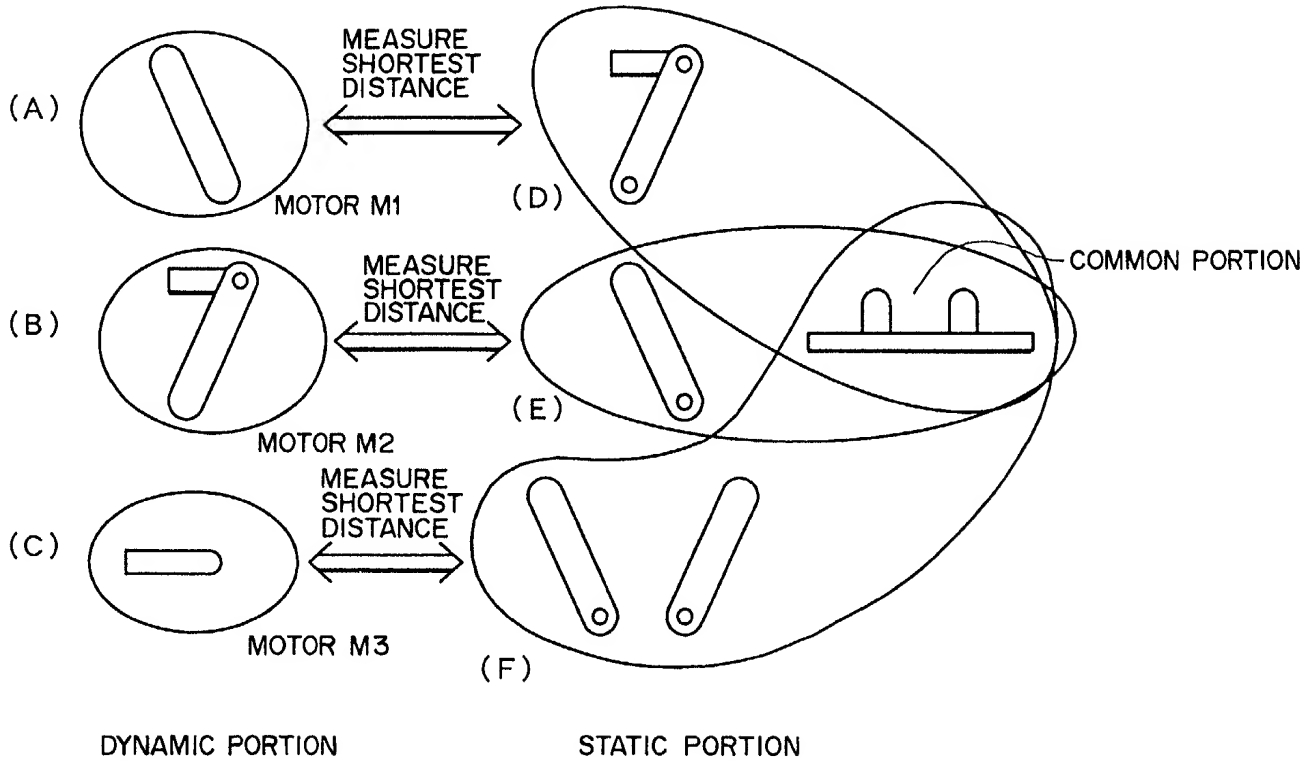


FIG. 40

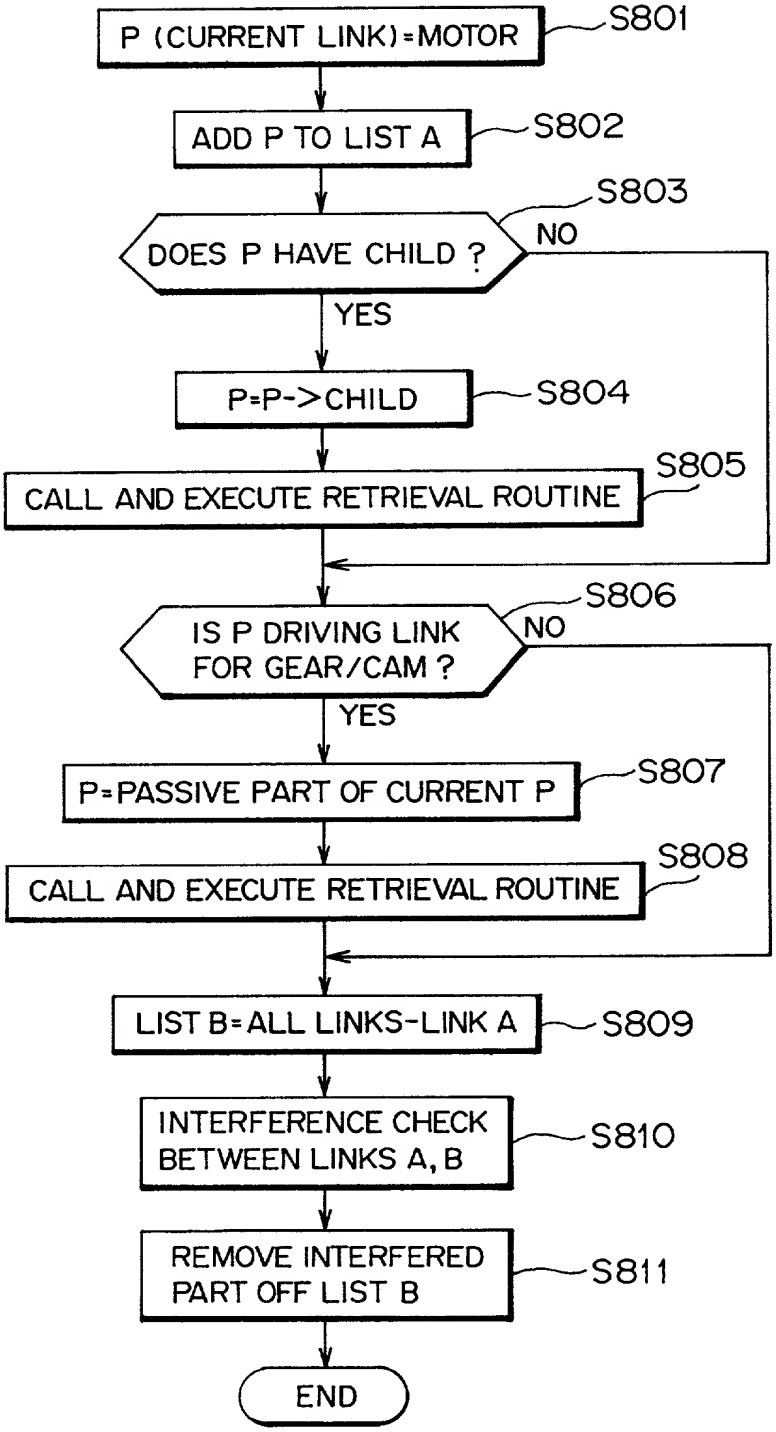

P (CURRENT LINK)=MOTOR
S801
ADD P TO LIST A
S802
DOES P HAVE CHILD ?
S803
NO
YES
P=P->CHILD
S804
CALL AND EXECUTE RETRIEVAL ROUTINE
S805
IS P DRIVING LINK FOR GEAR/CAM ?
S806
NO
YES
P=PASSIVE PART OF CURRENT P
S807
CALL AND EXECUTE RETRIEVAL ROUTINE
S808
LIST B=ALL LINKS-LINK A
S809
INTERFERENCE CHECK BETWEEN LINKS A, B
S810
REMOVE INTERFERED PART OFF LIST B
S811
END

FIG. 41

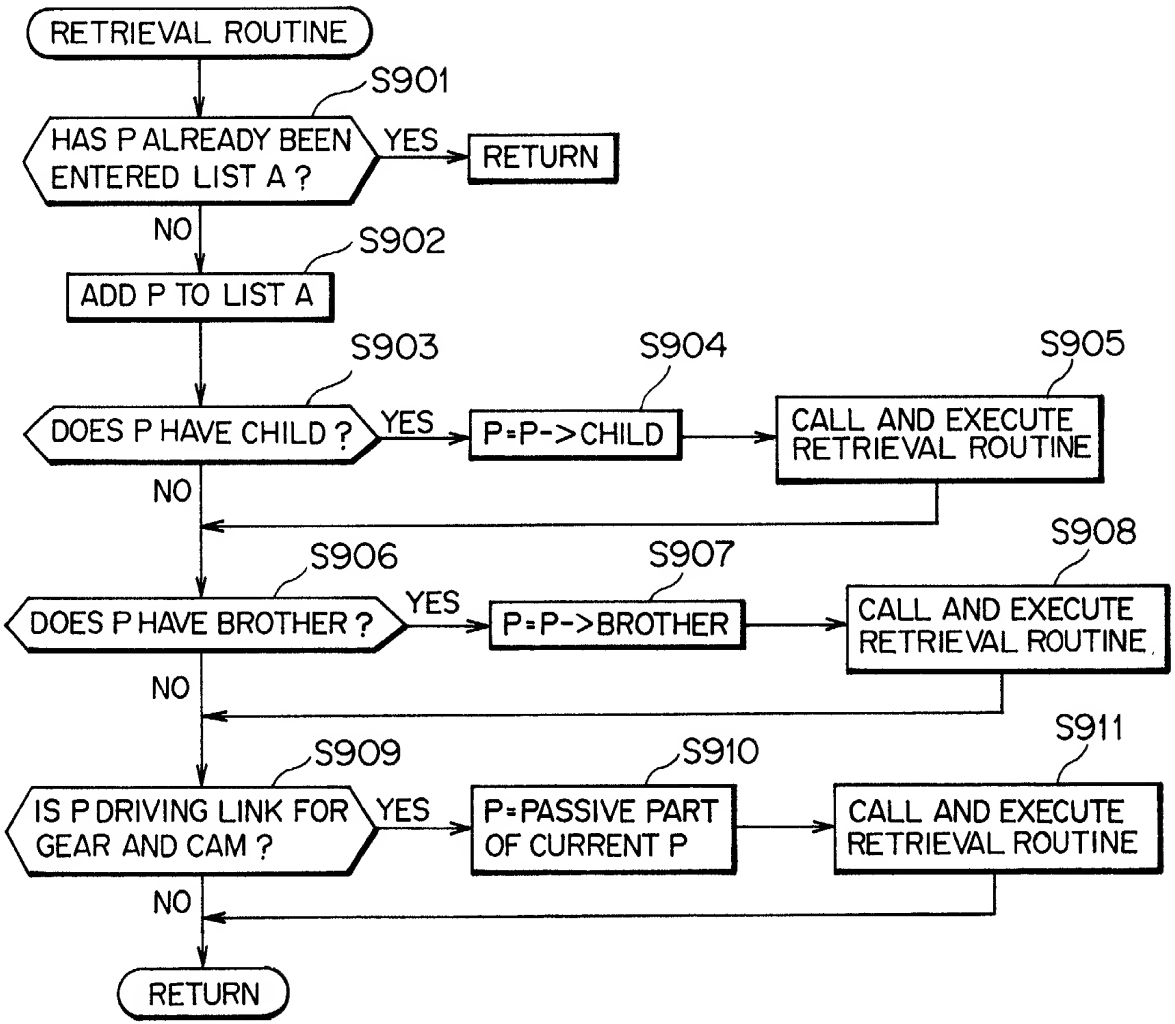

RETRIEVAL ROUTINE
S901
HAS P ALREADY BEEN ENTERED LIST A ?
YES
RETURN
NO
S902
ADD P TO LIST A
S903
S904
S905
DOES P HAVE CHILD ?
YES
P=P->CHILD
CALL AND EXECUTE RETRIEVAL ROUTINE
NO
S906
S907
S908
DOES P HAVE BROTHER ?
YES
P=P->BROTHER
CALL AND EXECUTE RETRIEVAL ROUTINE
NO
S909
S910
S911
IS P DRIVING LINK FOR GEAR AND CAM ?
YES
P=PASSIVE PART OF CURRENT P
CALL AND EXECUTE RETRIEVAL ROUTINE
NO
RETURN

FIG. 42

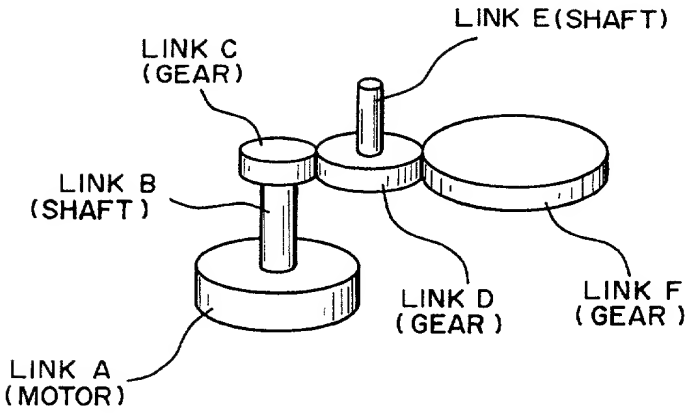

LINK E(SHAFT)
LINK C
(GEAR)
LINK B
(SHAFT)
LINK D
(GEAR)
LINK F
(GEAR)
LINK A
(MOTOR)

FIG. 43

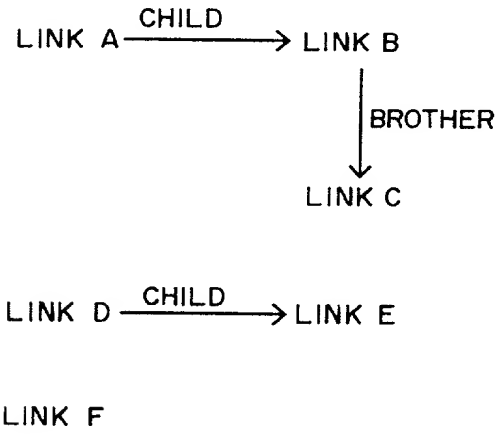

LINK A
CHILD
LINK B
BROTHER
LINK C
LINK D
CHILD
LINK E
LINK F

FIG. 44A

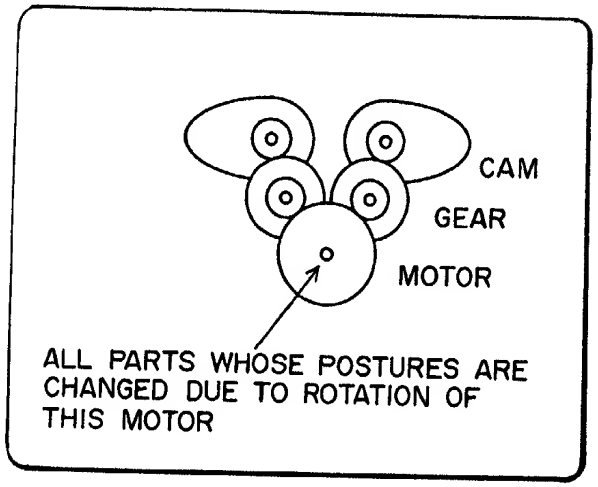


FIG. 44B

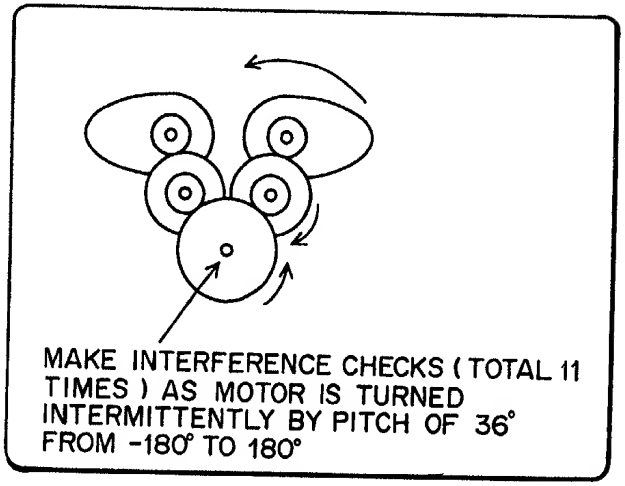


FIG. 44C

LINK A AND LINK B	2
LINK A AND LINK C	3
LINK B AND LINK D	4
LINK B AND LINK E	11
LINK C AND LINK E	8
LINK D AND LINK E	11

SETS OF INTERFERED PARTS, AND FREQUENCY OF INTERFERENCE

FIG. 44D

LINK A AND LINK B	2
LINK A AND LINK C	3
LINK B AND LINK D	4
LINK B AND LINK E	11
LINK C AND LINK E	8
LINK D AND LINK E	11

EXCLUDE, FROM LIST, SETS WHOSE PARTS INTERFERED IN ALL INTERFERENCE CHECKS

FIG. 45

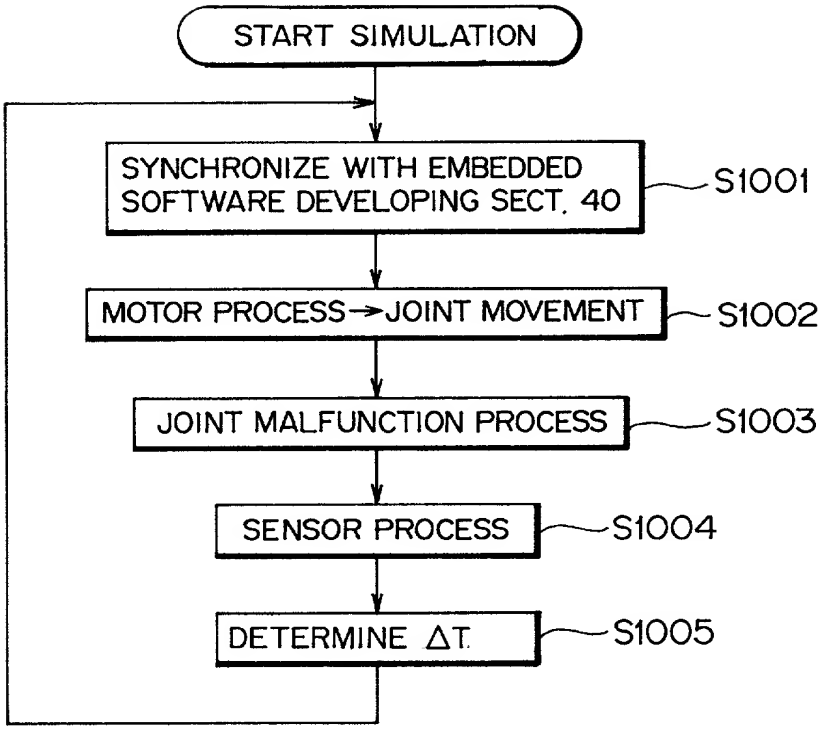

START SIMULATION
SYNCHRONIZE WITH EMBEDDED SOFTWARE DEVELOPING SECT. 40
S1001
MOTOR PROCESS→JOINT MOVEMENT
S1002
JOINT MALFUNCTION PROCESS
S1003
SENSOR PROCESS
S1004
DETERMINE ΔT
S1005

FIG. 46

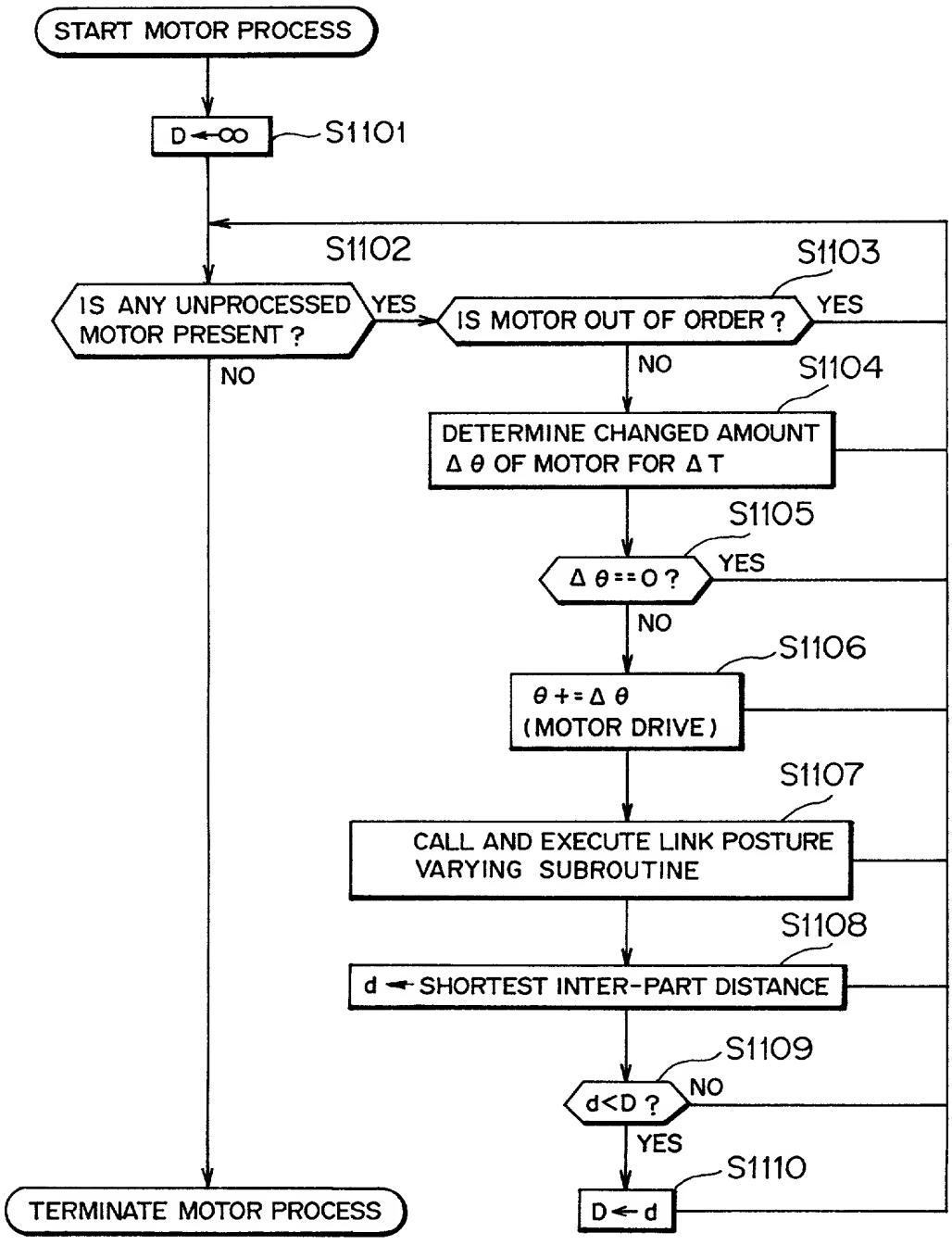

START MOTOR PROCESS
D←∞
S1101
S1102
IS ANY UNPROCESSED MOTOR PRESENT ?
YES
NO
S1103
IS MOTOR OUT OF ORDER ?
YES
NO
S1104
DETERMINE CHANGED AMOUNT Δθ OF MOTOR FOR ΔT
S1105
Δθ==0 ?
YES
NO
S1106
θ+=Δθ (MOTOR DRIVE)
S1107
CALL AND EXECUTE LINK POSTURE VARYING SUBROUTINE
S1108
d ← SHORTEST INTER-PART DISTANCE
S1109
d<D ?
NO
YES
S1110
D←d
TERMINATE MOTOR PROCESS

FIG. 47

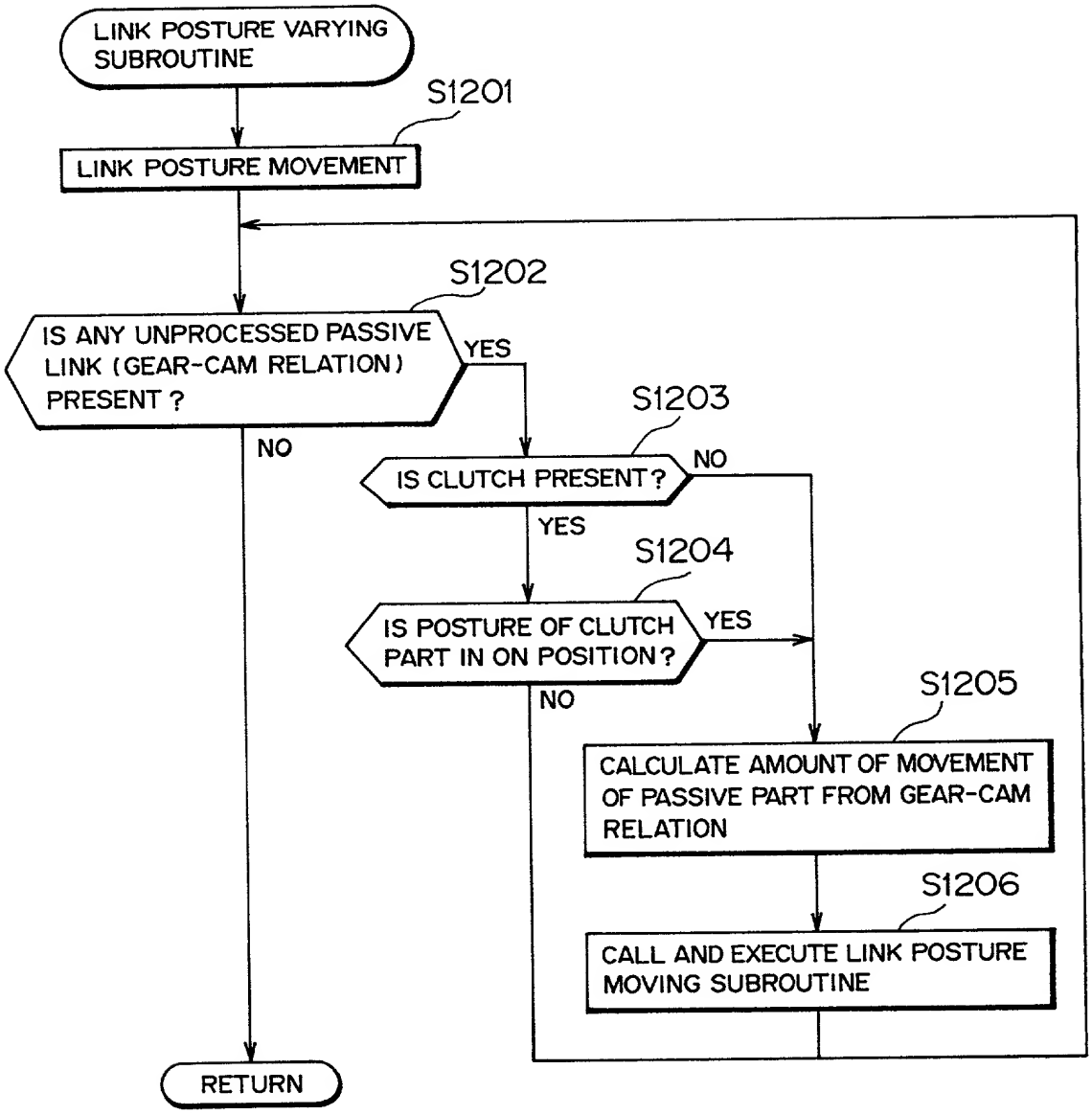

LINK POSTURE VARYING SUBROUTINE
S1201
LINK POSTURE MOVEMENT
S1202
IS ANY UNPROCESSED PASSIVE LINK (GEAR-CAM RELATION) PRESENT ?
YES
NO
S1203
IS CLUTCH PRESENT?
NO
YES
S1204
IS POSTURE OF CLUTCH PART IN ON POSITION?
YES
NO
S1205
CALCULATE AMOUNT OF MOVEMENT OF PASSIVE PART FROM GEAR-CAM RELATION
S1206
CALL AND EXECUTE LINK POSTURE MOVING SUBROUTINE
RETURN

FIG. 48

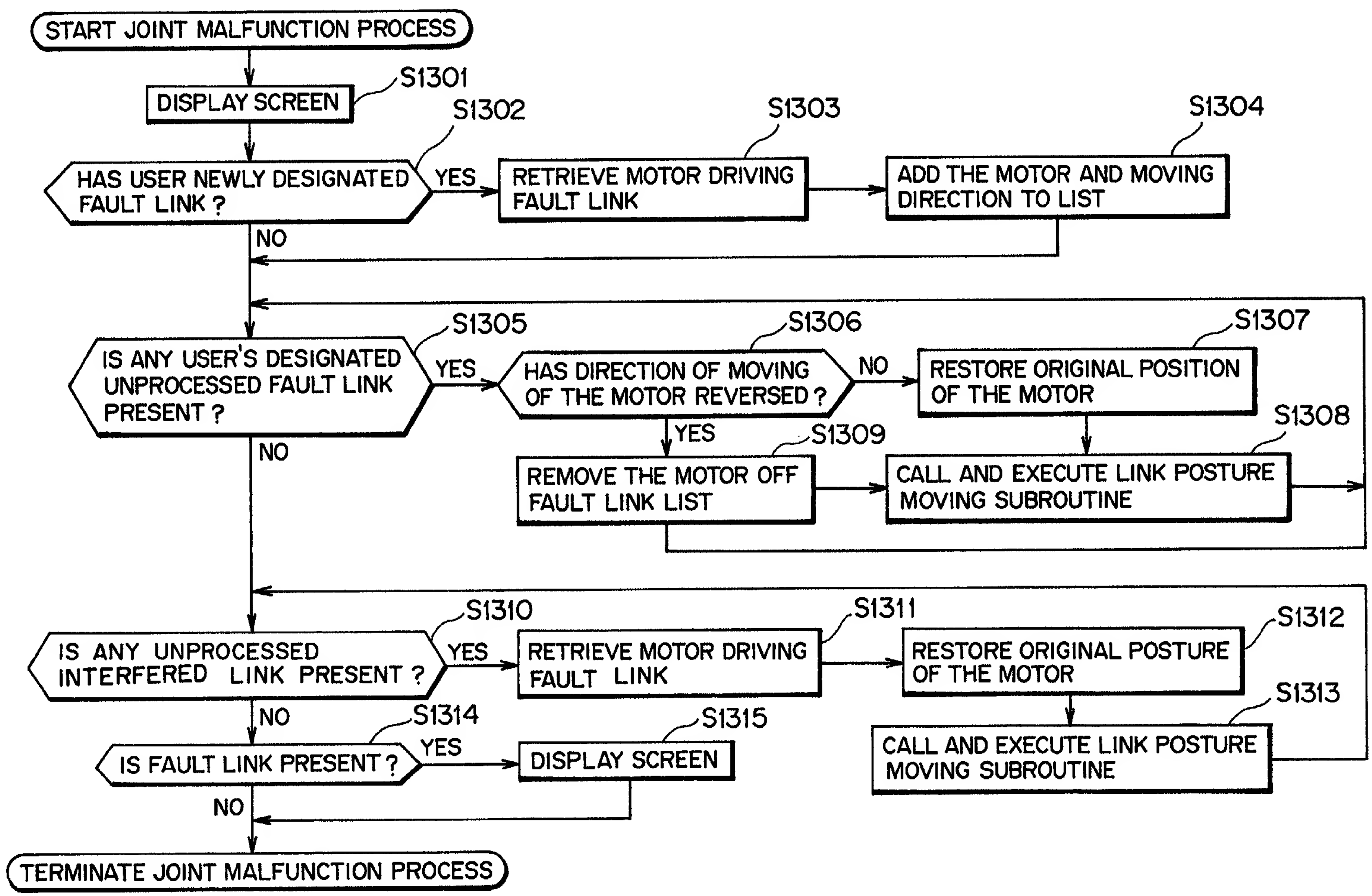

START JOINT MALFUNCTION PROCESS
DISPLAY SCREEN
S1301
S1302
HAS USER NEWLY DESIGNATED FAULT LINK ?
YES
NO
S1303
RETRIEVE MOTOR DRIVING FAULT LINK
S1304
ADD THE MOTOR AND MOVING DIRECTION TO LIST
S1305
IS ANY USER'S DESIGNATED UNPROCESSED FAULT LINK PRESENT ?
YES
NO
S1306
HAS DIRECTION OF MOVING OF THE MOTOR REVERSED ?
NO
YES
S1307
RESTORE ORIGINAL POSITION OF THE MOTOR
S1308
CALL AND EXECUTE LINK POSTURE MOVING SUBROUTINE
S1309
REMOVE THE MOTOR OFF FAULT LINK LIST
S1310
IS ANY UNPROCESSED INTERFERED LINK PRESENT ?
YES
NO
S1311
RETRIEVE MOTOR DRIVING FAULT LINK
S1312
RESTORE ORIGINAL POSTURE OF THE MOTOR
S1313
CALL AND EXECUTE LINK POSTURE MOVING SUBROUTINE
S1314
IS FAULT LINK PRESENT ?
YES
NO
S1315
DISPLAY SCREEN
TERMINATE JOINT MALFUNCTION PROCESS

FIG. 49

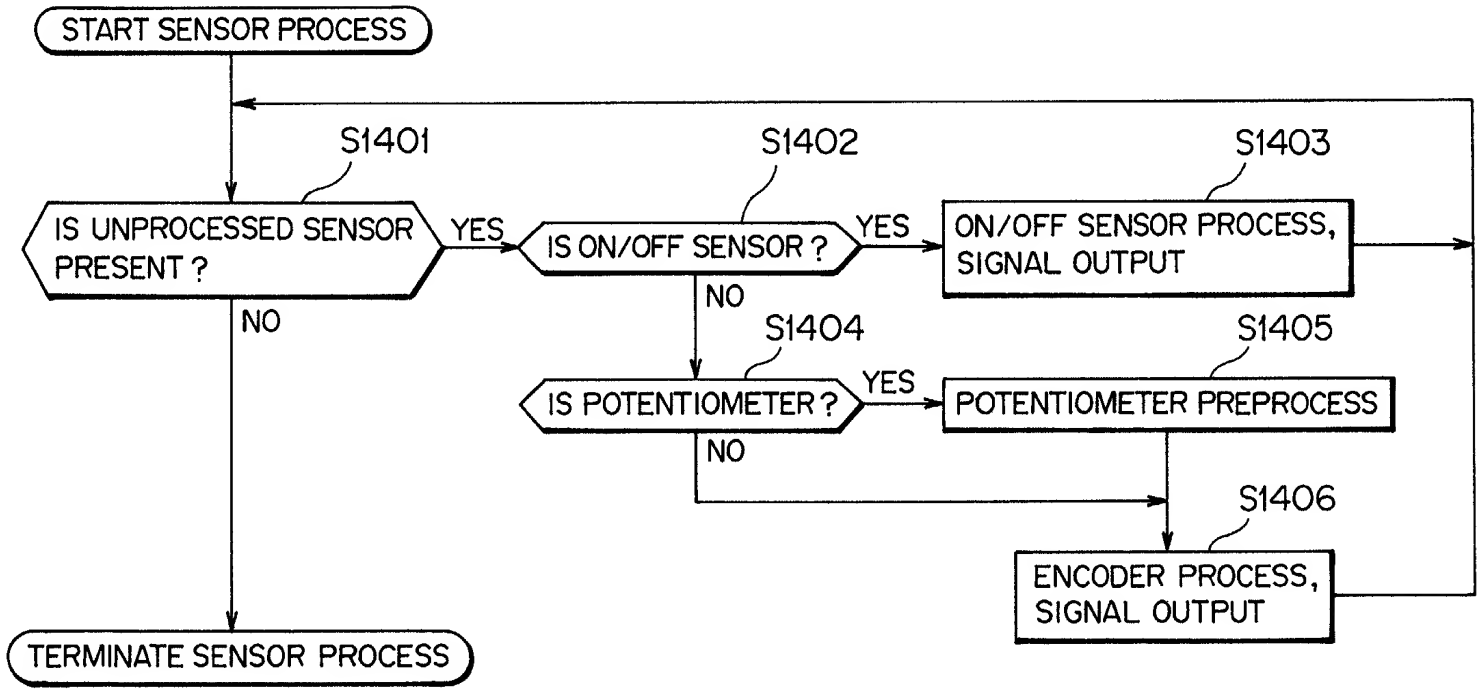


FIG. 50

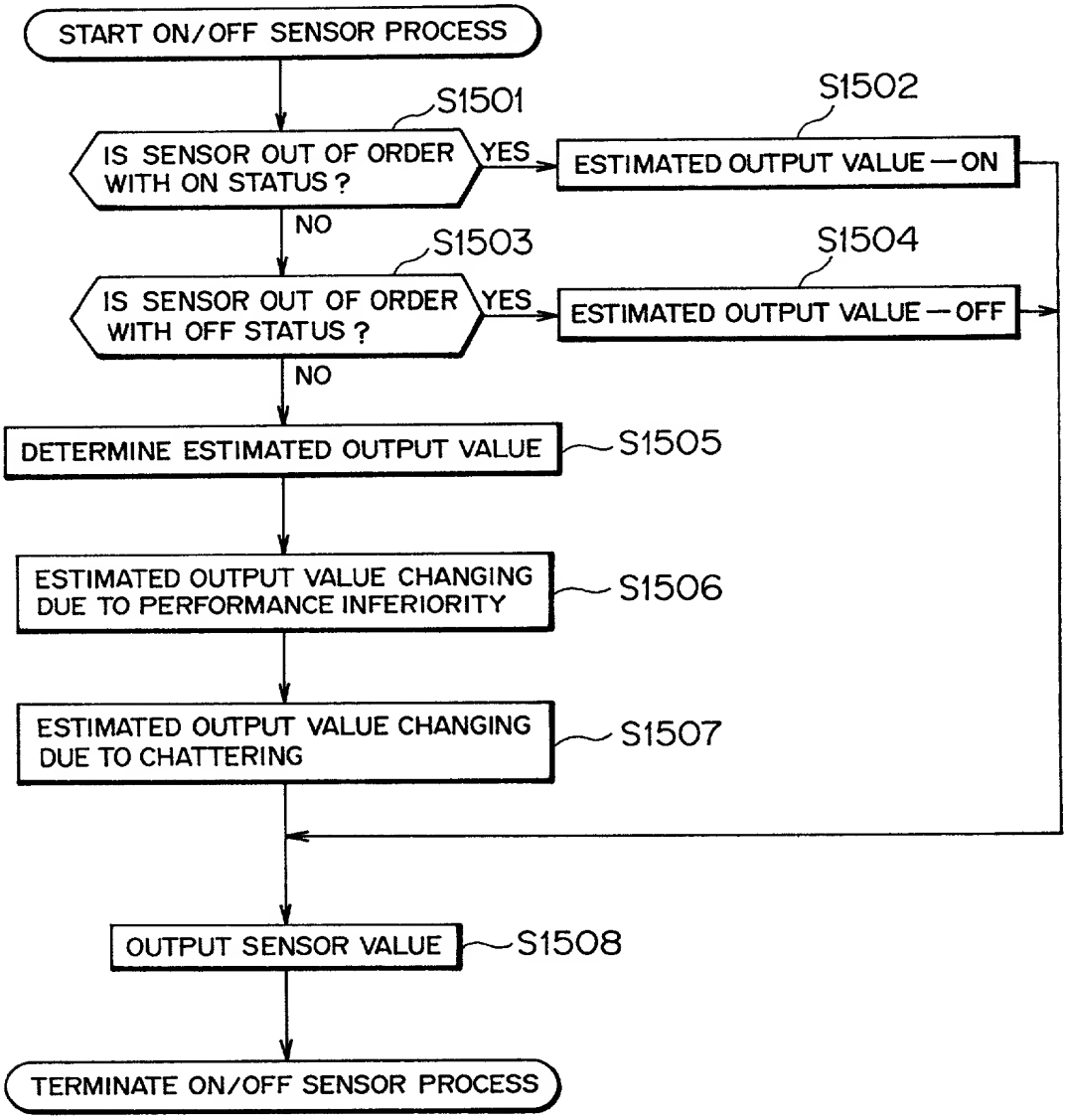
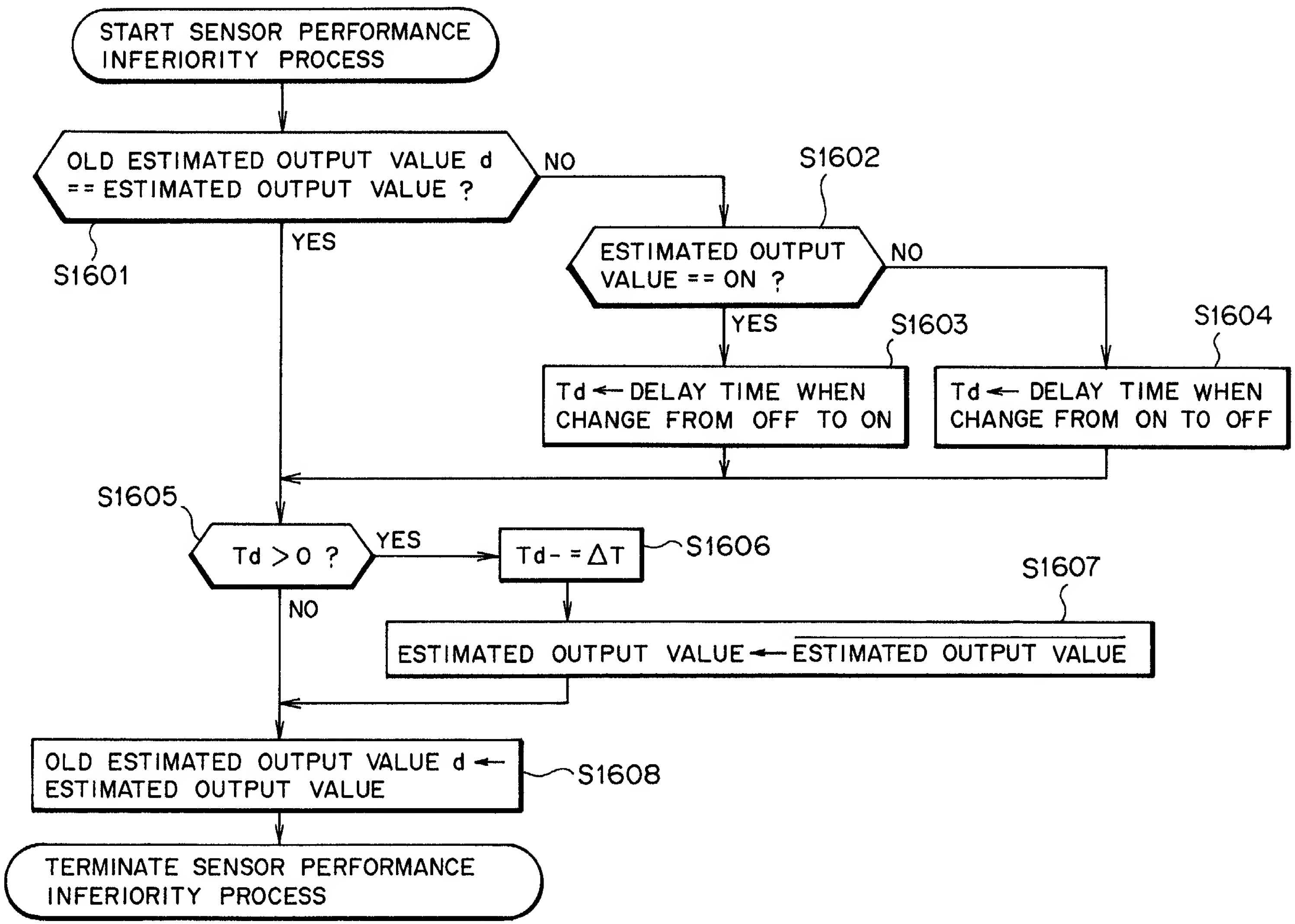

START ON/OFF SENSOR PROCESS
S1501
IS SENSOR OUT OF ORDER WITH ON STATUS ?
YES
S1502
ESTIMATED OUTPUT VALUE — ON
NO
S1503
IS SENSOR OUT OF ORDER WITH OFF STATUS ?
YES
S1504
ESTIMATED OUTPUT VALUE — OFF
NO
DETERMINE ESTIMATED OUTPUT VALUE
S1505
ESTIMATED OUTPUT VALUE CHANGING DUE TO PERFORMANCE INFERIORITY
S1506
ESTIMATED OUTPUT VALUE CHANGING DUE TO CHATTERING
S1507
OUTPUT SENSOR VALUE
S1508
TERMINATE ON/OFF SENSOR PROCESS

FIG. 51



START SENSOR PERFORMANCE INFERIORITY PROCESS
OLD ESTIMATED OUTPUT VALUE d == ESTIMATED OUTPUT VALUE ?
S1601
YES
NO
S1602
ESTIMATED OUTPUT VALUE == ON ?
YES
NO
S1603
Td ← DELAY TIME WHEN CHANGE FROM OFF TO ON
S1604
Td ← DELAY TIME WHEN CHANGE FROM ON TO OFF
S1605
Td > 0 ?
YES
NO
Td- = ΔT
S1606
S1607
ESTIMATED OUTPUT VALUE ← ESTIMATED OUTPUT VALUE
OLD ESTIMATED OUTPUT VALUE d ← ESTIMATED OUTPUT VALUE
S1608
TERMINATE SENSOR PERFORMANCE INFERIORITY PROCESS

FIG. 52

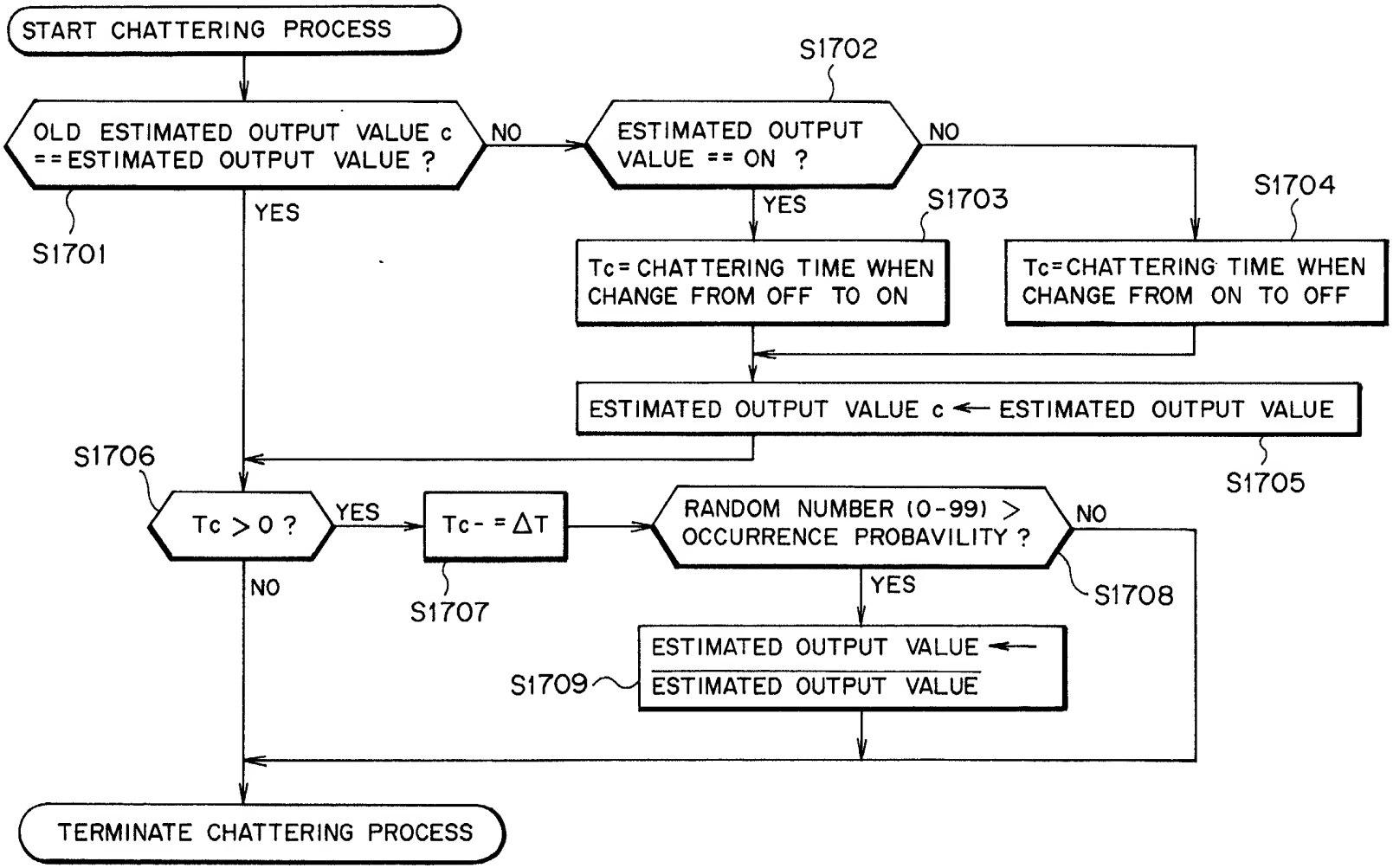

START CHATTERING PROCESS
OLD ESTIMATED OUTPUT VALUE c == ESTIMATED OUTPUT VALUE ?
NO
YES
S1701
S1702
ESTIMATED OUTPUT VALUE == ON ?
NO
YES
S1703
Tc = CHATTERING TIME WHEN CHANGE FROM OFF TO ON
S1704
Tc = CHATTERING TIME WHEN CHANGE FROM ON TO OFF
ESTIMATED OUTPUT VALUE c ← ESTIMATED OUTPUT VALUE
S1705
S1706
Tc > 0 ?
YES
NO
Tc - = ΔT
S1707
RANDOM NUMBER (0-99) > OCCURRENCE PROBAVILITY ?
NO
YES
S1708
S1709
ESTIMATED OUTPUT VALUE ←
ESTIMATED OUTPUT VALUE
TERMINATE CHATTERING PROCESS

FIG. 53

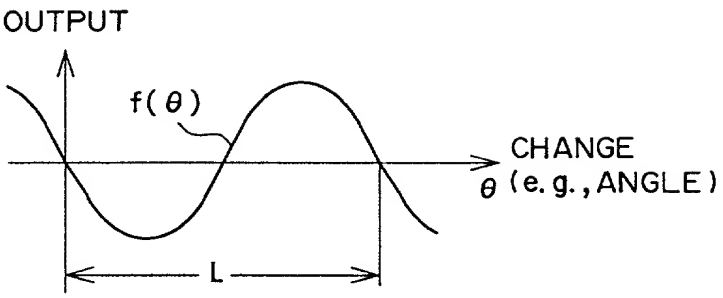


FIG. 54A

RECTANGULAR WAVE

FIG. 54B

SIGN WAVE

FIG. 54C

TRIANGULAR WAVE

FIG. 54D

SAWTEETH WAVE (RIGHT SIDE UP)

FIG. 54E

SAWTEETH WAVE (RIGHT SIDE DOWN)

FIG. 55

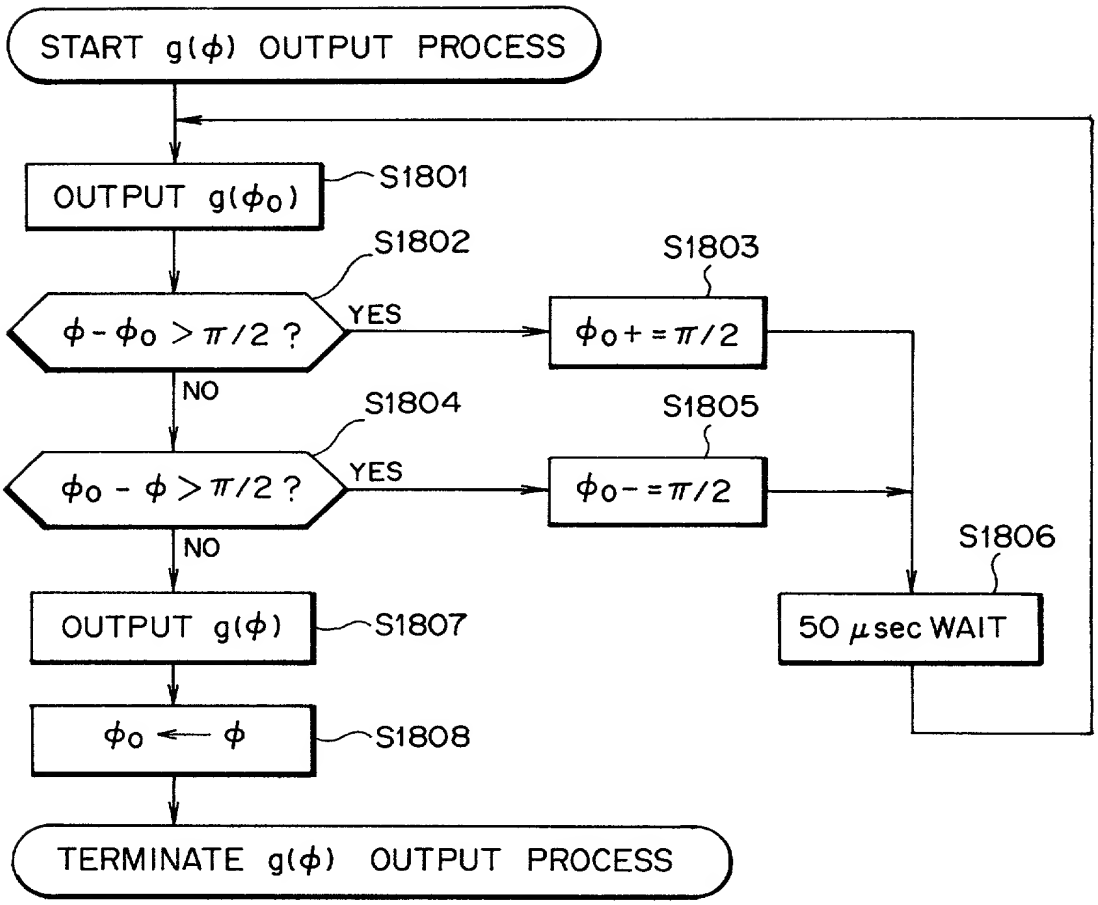

START g(φ) OUTPUT PROCESS
OUTPUT g(φ0)
S1801
S1802
φ - φ0 > π/2 ?
YES
S1803
φ0 + = π/2
NO
S1804
φ0 - φ > π/2 ?
YES
S1805
φ0 - = π/2
NO
S1806
50 μsec WAIT
OUTPUT g(φ)
S1807
φ0 ← φ
S1808
TERMINATE g(φ) OUTPUT PROCESS

FIG. 56

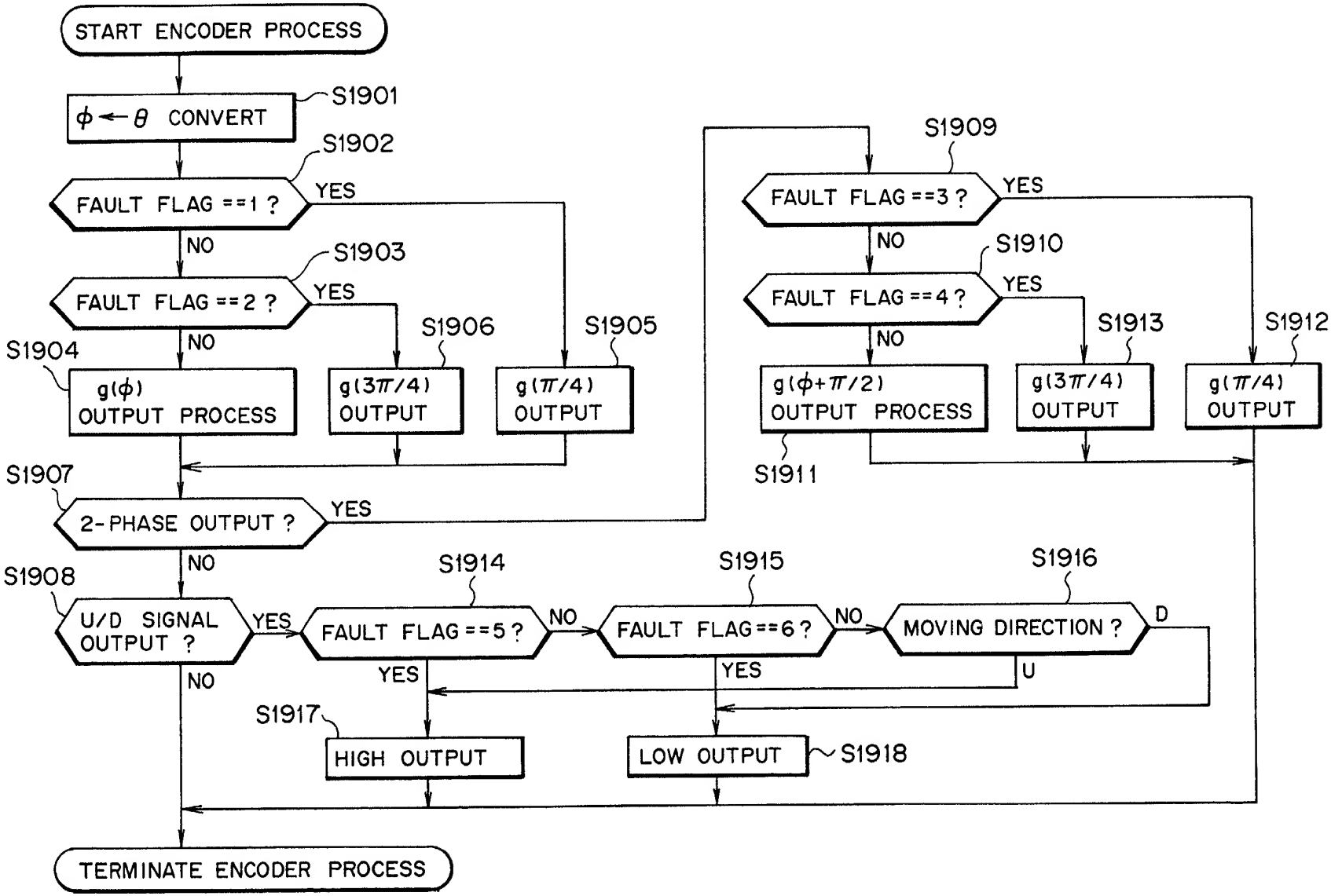

START ENCODER PROCESS
S1901
φ ← θ CONVERT
S1902
FAULT FLAG ==1 ?
YES
NO
S1903
FAULT FLAG ==2 ?
YES
NO
S1904
g(φ)
OUTPUT PROCESS
S1906
g(3π/4)
OUTPUT
S1905
g(π/4)
OUTPUT
S1907
2-PHASE OUTPUT ?
YES
NO
S1908
U/D SIGNAL
OUTPUT ?
YES
NO
S1914
FAULT FLAG ==5 ?
NO
YES
S1915
FAULT FLAG ==6 ?
NO
YES
S1916
MOVING DIRECTION ?
D
U
S1917
HIGH OUTPUT
LOW OUTPUT
S1918
S1909
FAULT FLAG ==3 ?
YES
NO
S1910
FAULT FLAG ==4 ?
YES
NO
S1911
g(φ+π/2)
OUTPUT PROCESS
S1913
g(3π/4)
OUTPUT
S1912
g(π/4)
OUTPUT
TERMINATE ENCODER PROCESS

FIG.57

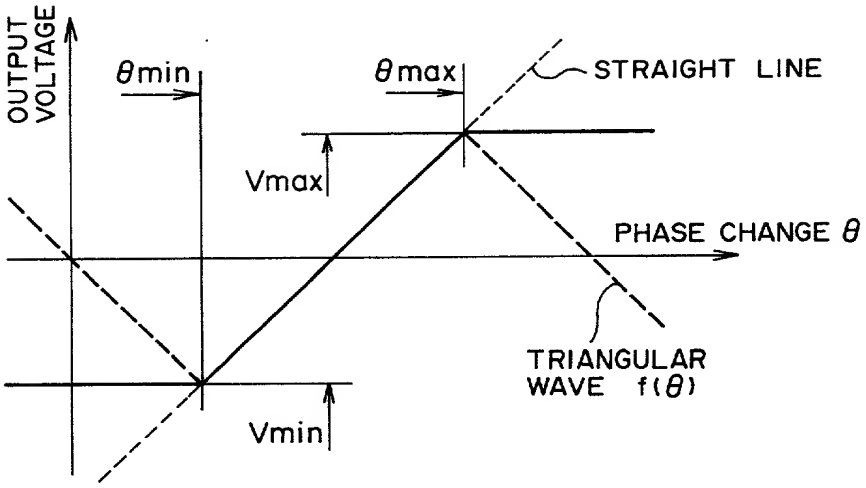

OUTPUT VOLTAGE
θmin
θmax
STRAIGHT LINE
Vmax
PHASE CHANGE θ
TRIANGULAR WAVE f(θ)
Vmin

FIG.58

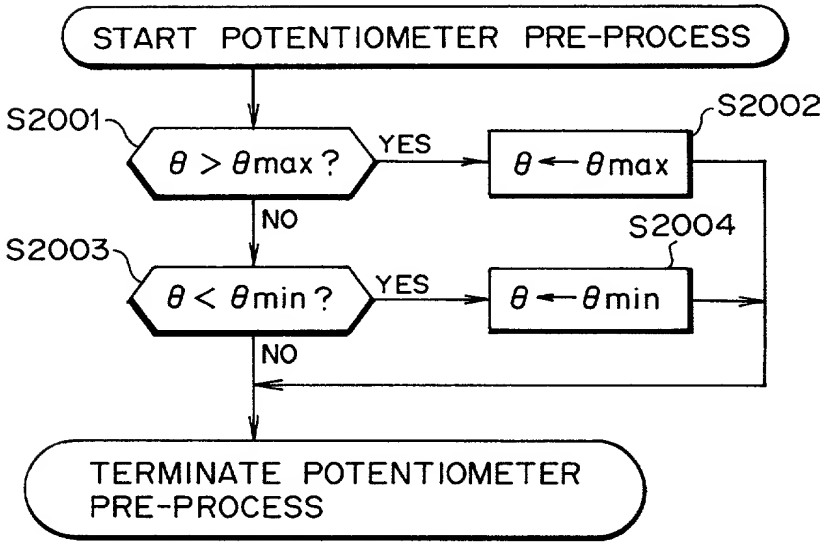

START POTENTIOMETER PRE-PROCESS
S2001
θ > θmax ?
YES
S2002
θ ← θmax
NO
S2003
S2004
θ < θmin ?
YES
θ ← θmin
NO
TERMINATE POTENTIOMETER PRE-PROCESS

FIG. 59

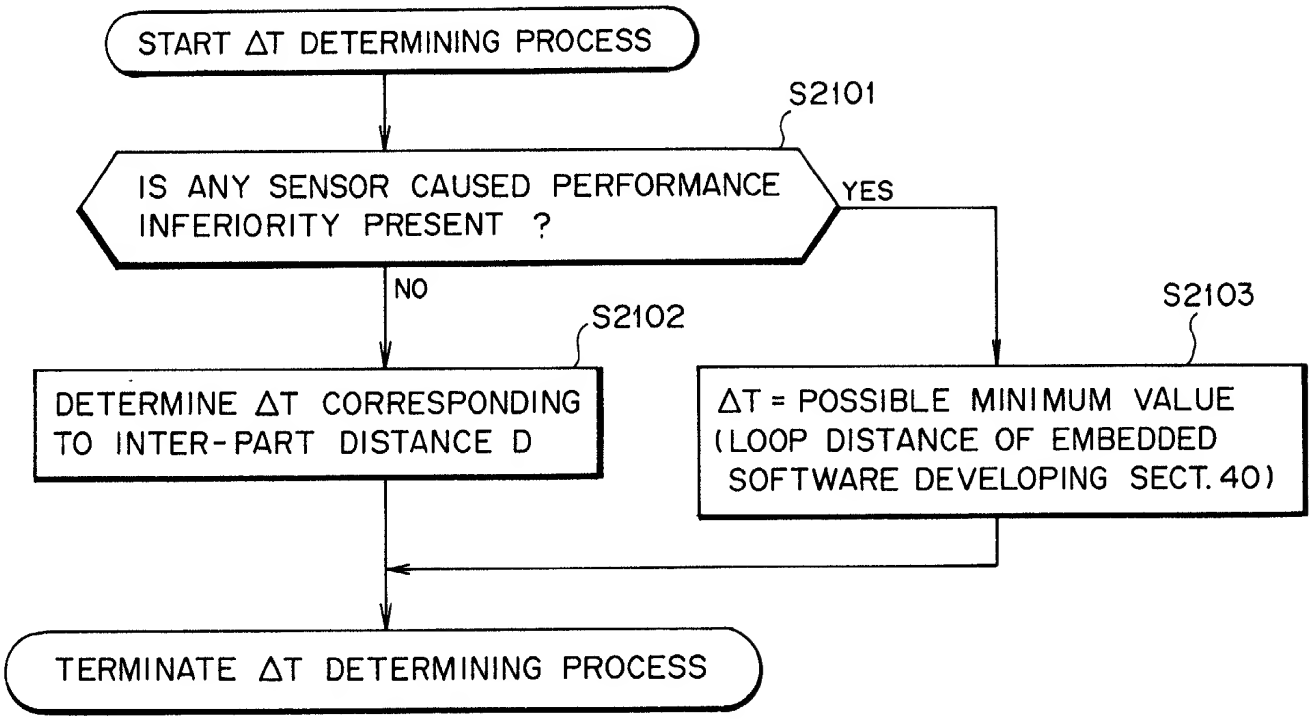

START ΔT DETERMINING PROCESS
S2101
IS ANY SENSOR CAUSED PERFORMANCE INFERIORITY PRESENT ?
YES
NO
S2102
DETERMINE ΔT CORRESPONDING TO INTER-PART DISTANCE D
S2103
ΔT = POSSIBLE MINIMUM VALUE (LOOP DISTANCE OF EMBEDDED SOFTWARE DEVELOPING SECT. 40)
TERMINATE ΔT DETERMINING PROCESS

FIG. 60A

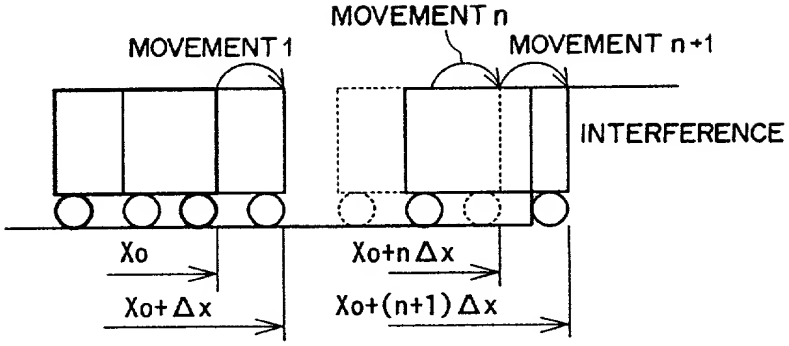


FIG. 60B

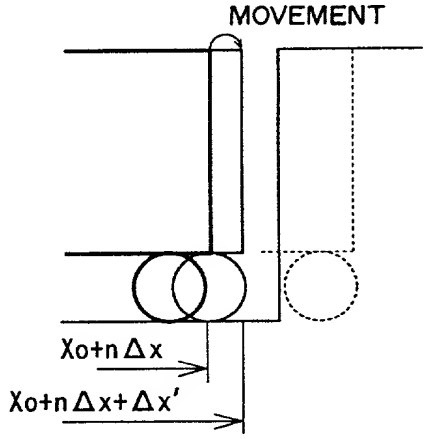


FIG. 61A

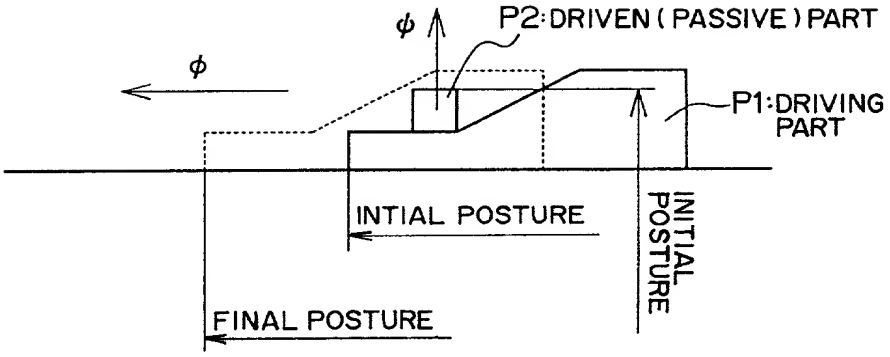


FIG. 61B

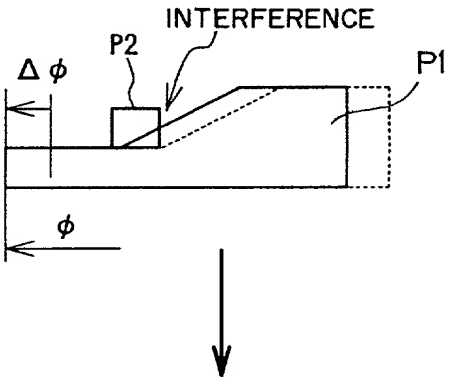


FIG. 61C

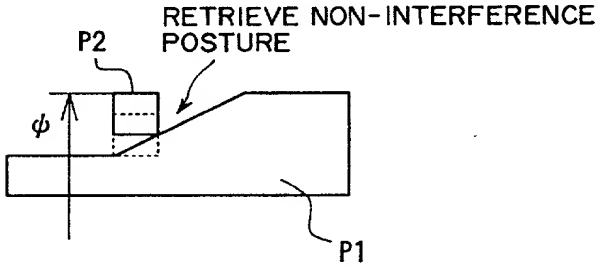


FIG. 62

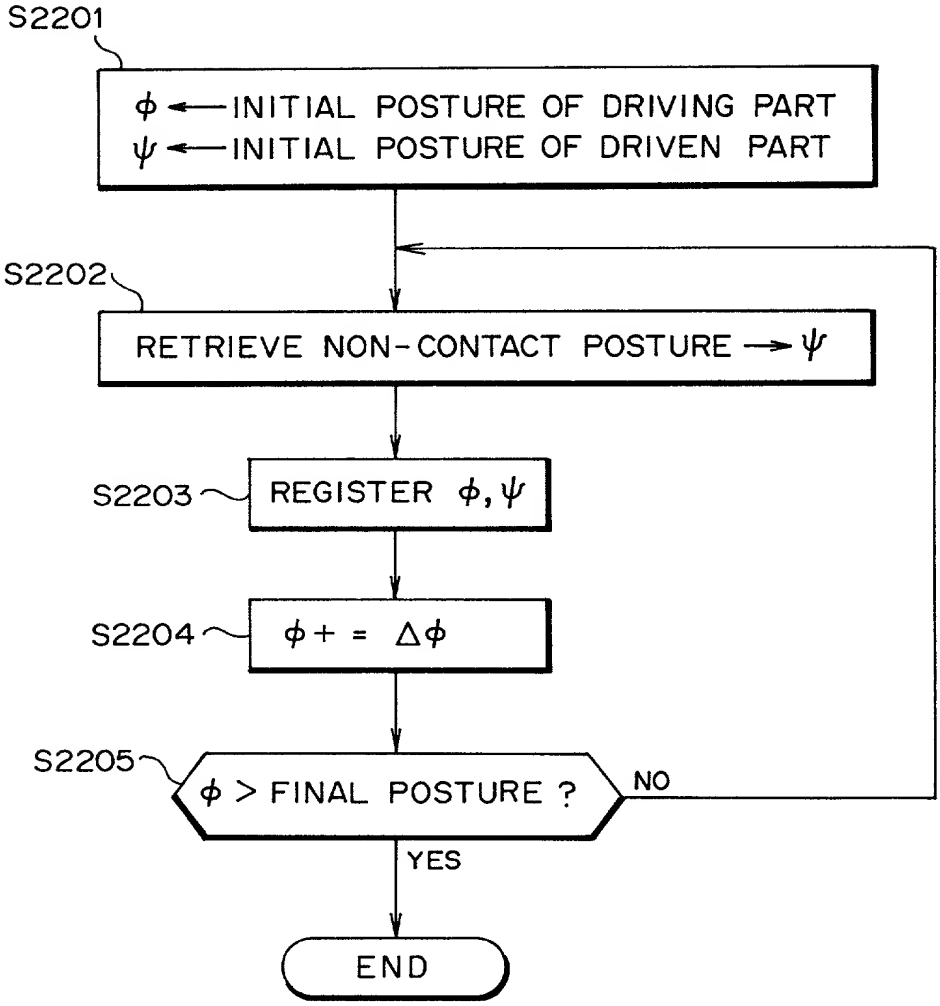

S2201
φ ← INITIAL POSTURE OF DRIVING PART
ψ ← INITIAL POSTURE OF DRIVEN PART
S2202
RETRIEVE NON-CONTACT POSTURE → ψ
S2203
REGISTER φ, ψ
S2204
φ + = Δφ
S2205
φ > FINAL POSTURE ?
NO
YES
END

FIG.63

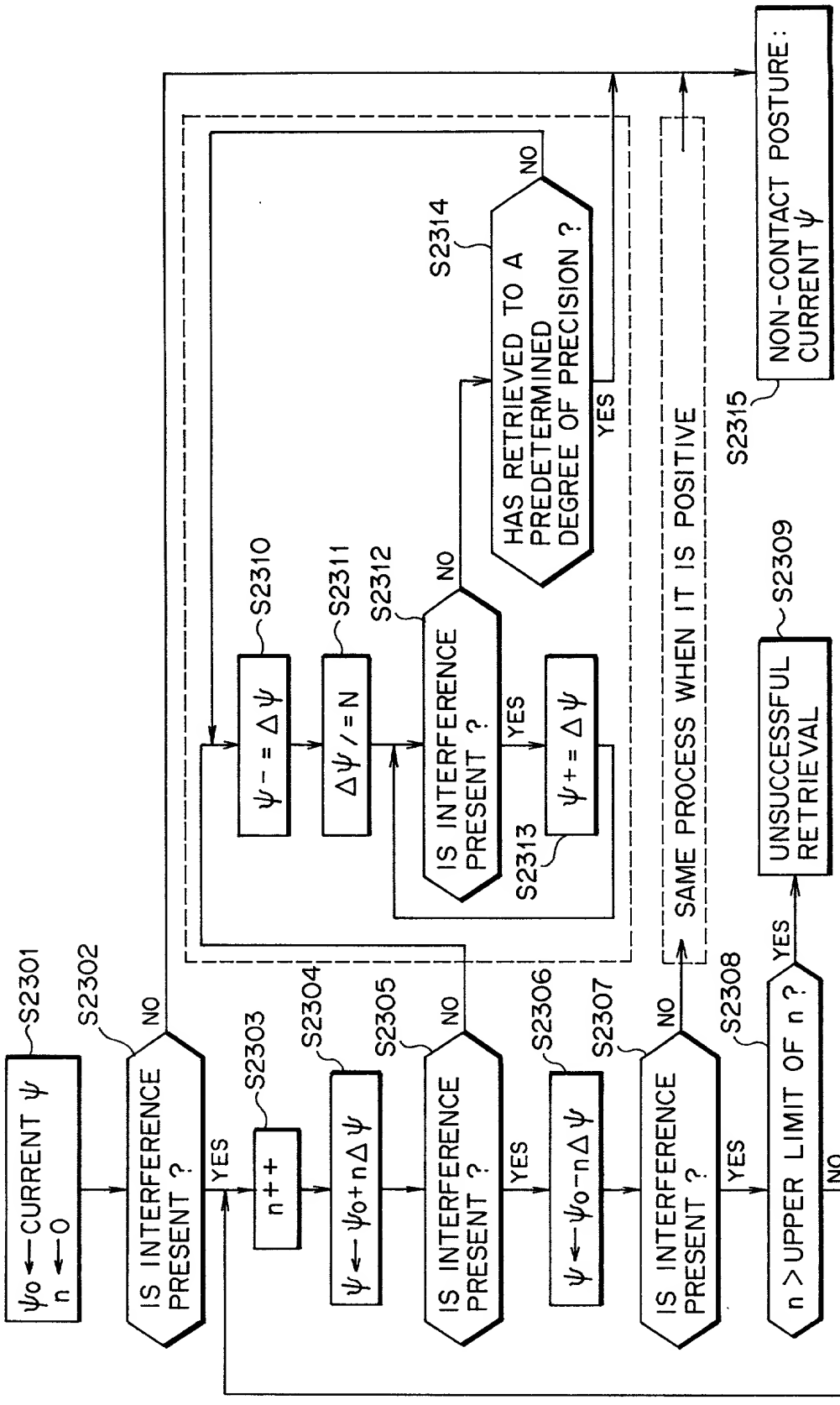

ψo ← CURRENT ψ
n ← 0
S2301
IS INTERFERENCE PRESENT ?
S2302
NO
YES
n++
S2303
ψ ← ψo+nΔψ
S2304
IS INTERFERENCE PRESENT ?
S2305
NO
YES
ψ ← ψo−nΔψ
S2306
IS INTERFERENCE PRESENT ?
S2307
NO
YES
n > UPPER LIMIT OF n ?
S2308
YES
NO
UNSUCCESSFUL RETRIEVAL
S2309
SAME PROCESS WHEN IT IS POSITIVE
NON-CONTACT POSTURE: CURRENT ψ
S2315
ψ− = Δψ
S2310
Δψ / = N
S2311
IS INTERFERENCE PRESENT ?
S2312
NO
YES
ψ+ = Δψ
S2313
HAS RETRIEVED TO A PREDETERMINED DEGREE OF PRECISION ?
S2314
NO
YES

FIG. 64

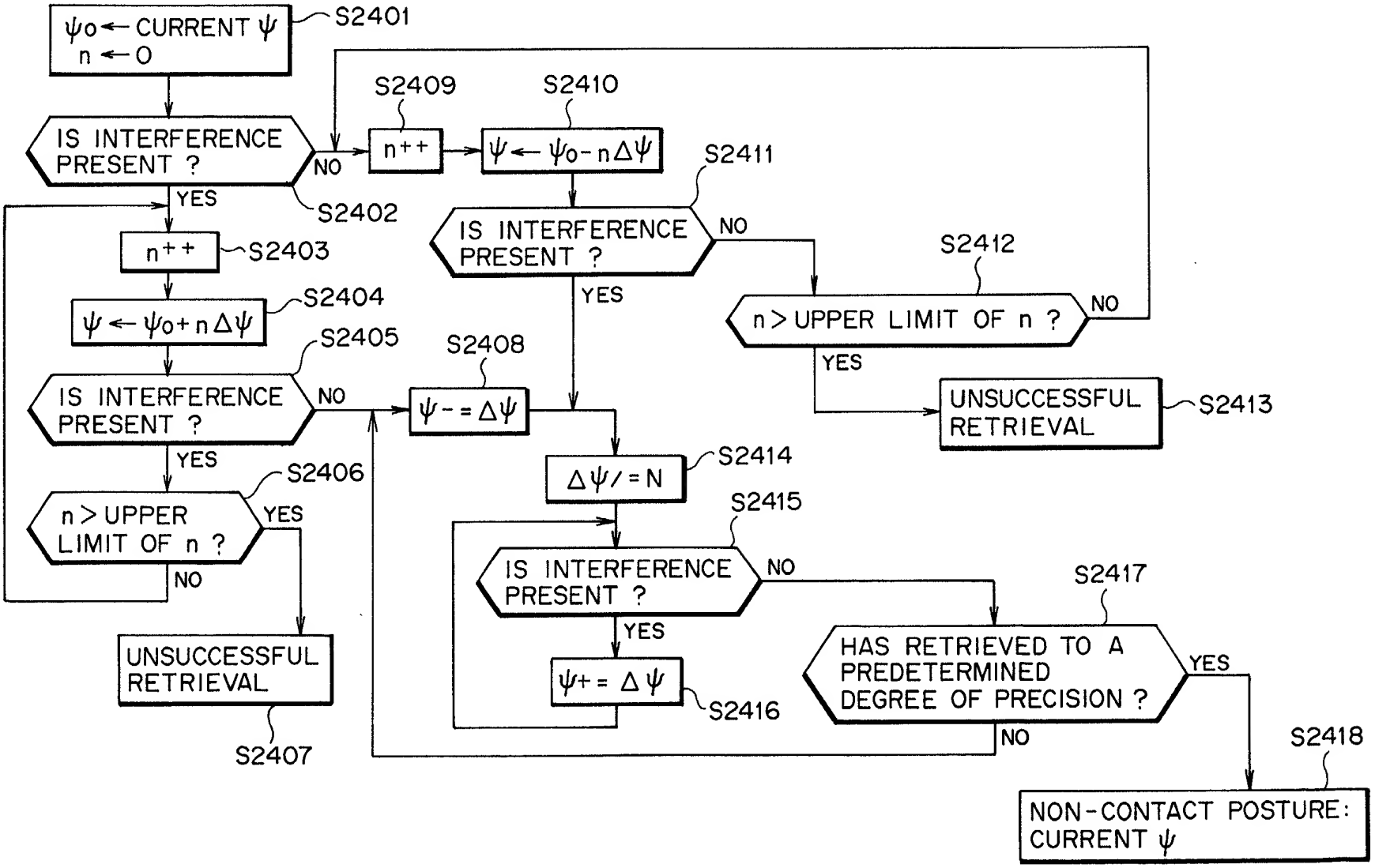


FIG. 65A

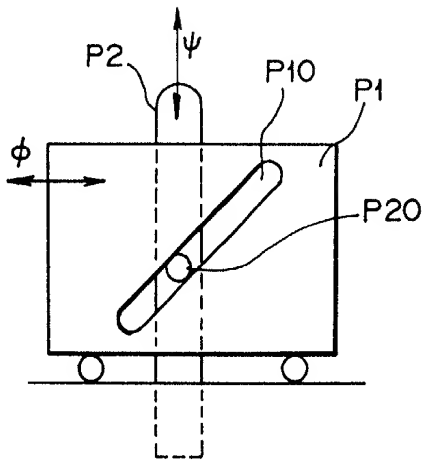


FIG. 65B

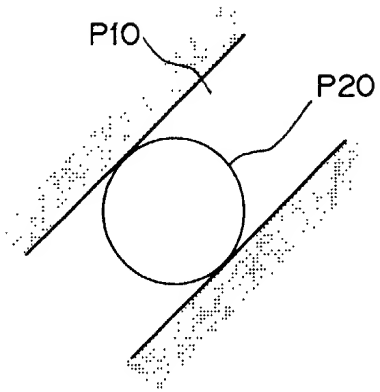


FIG. 65C

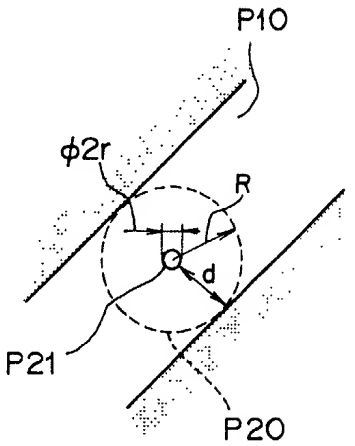


FIG. 66

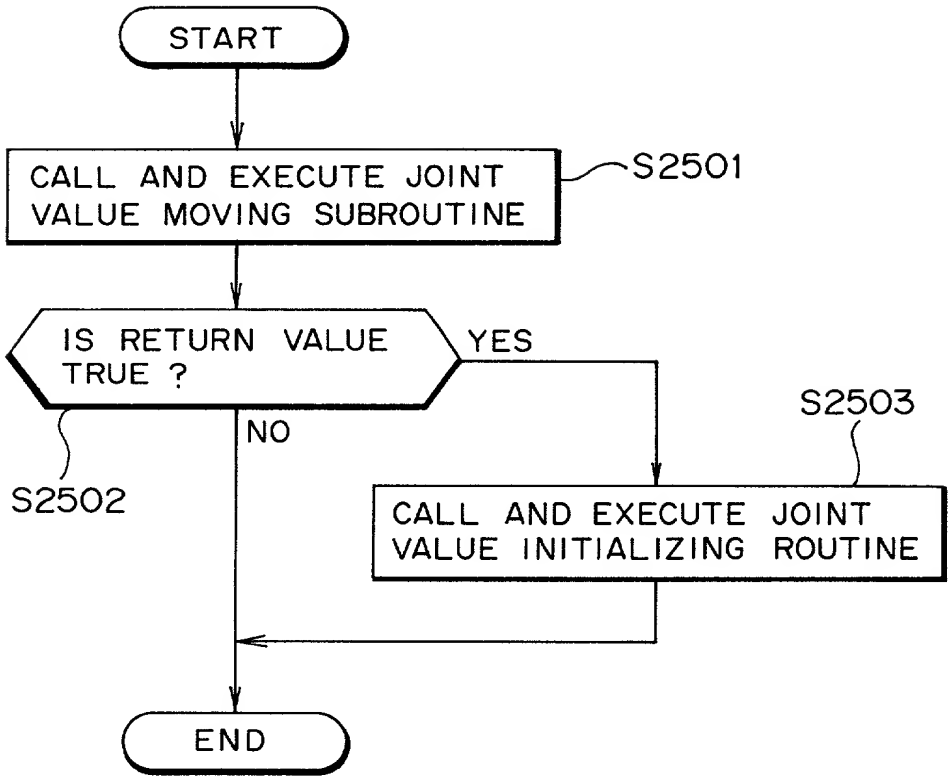

START
CALL AND EXECUTE JOINT VALUE MOVING SUBROUTINE
S2501
IS RETURN VALUE TRUE ?
YES
NO
S2502
S2503
CALL AND EXECUTE JOINT VALUE INITIALIZING ROUTINE
END

FIG. 67

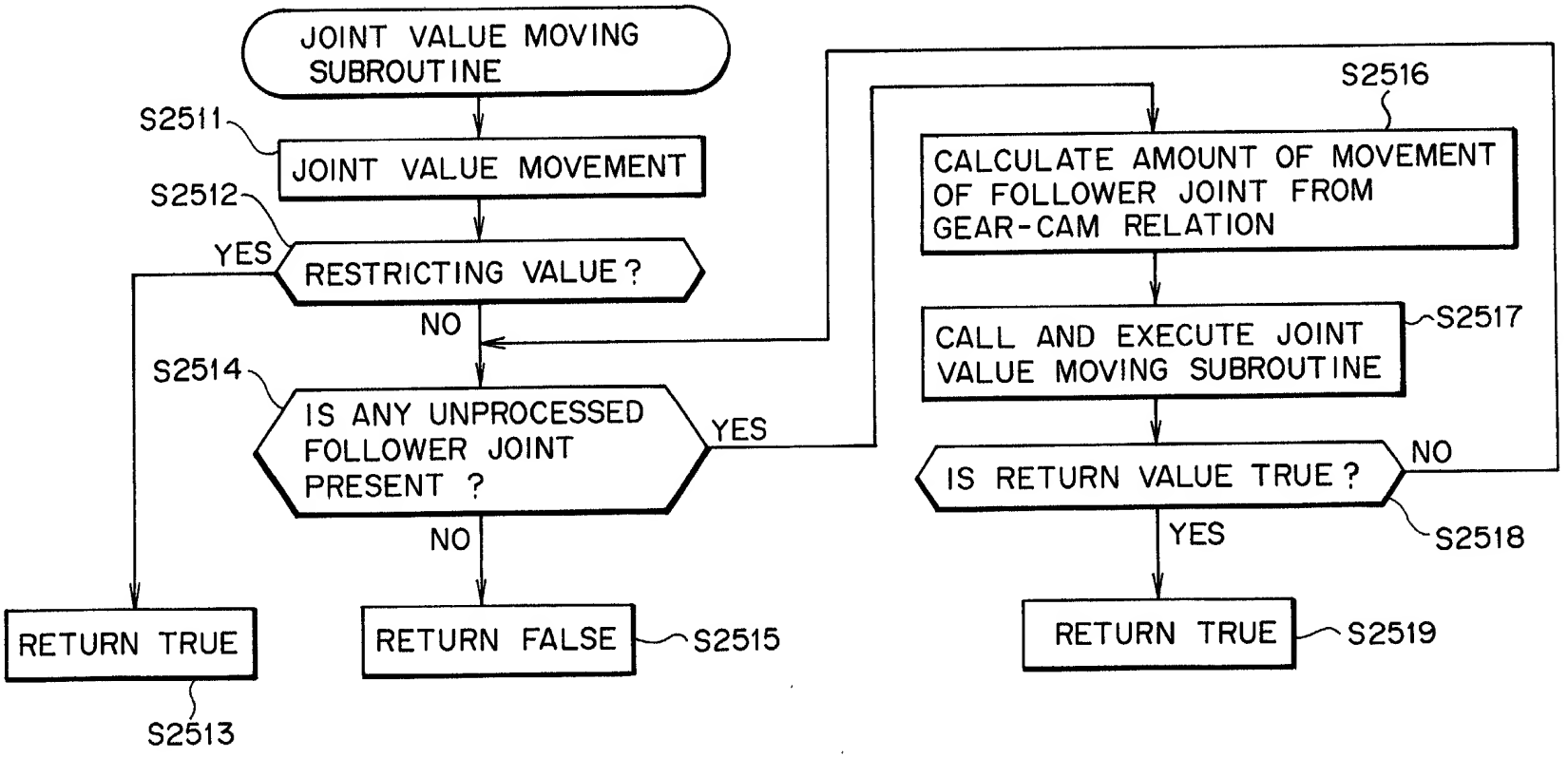

JOINT VALUE MOVING SUBROUTINE
S2511
JOINT VALUE MOVEMENT
S2512
YES
RESTRICTING VALUE ?
NO
S2514
IS ANY UNPROCESSED FOLLOWER JOINT PRESENT ?
YES
NO
RETURN TRUE
S2513
RETURN FALSE
S2515
S2516
CALCULATE AMOUNT OF MOVEMENT OF FOLLOWER JOINT FROM GEAR-CAM RELATION
CALL AND EXECUTE JOINT VALUE MOVING SUBROUTINE
S2517
IS RETURN VALUE TRUE ?
NO
S2518
YES
RETURN TRUE
S2519

FIG.68

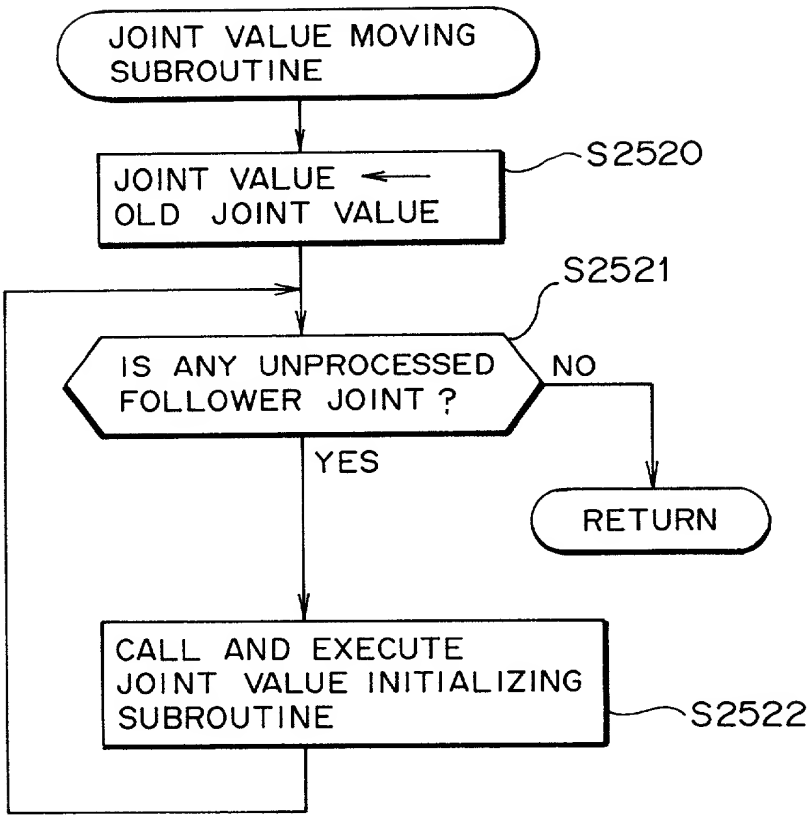

JOINT VALUE MOVING SUBROUTINE
JOINT VALUE ← OLD JOINT VALUE
S2520
S2521
IS ANY UNPROCESSED FOLLOWER JOINT ?
NO
YES
RETURN
CALL AND EXECUTE JOINT VALUE INITIALIZING SUBROUTINE
S2522

FIG. 69A

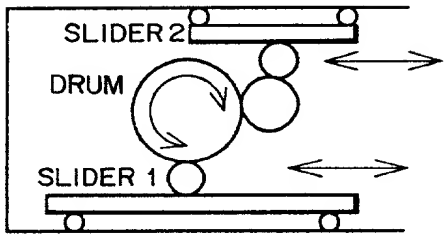


FIG. 69B

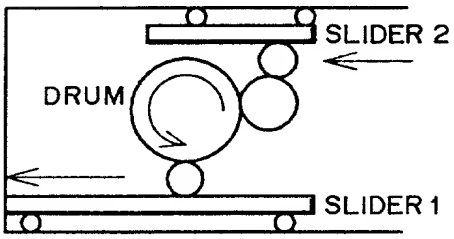


FIG. 69C

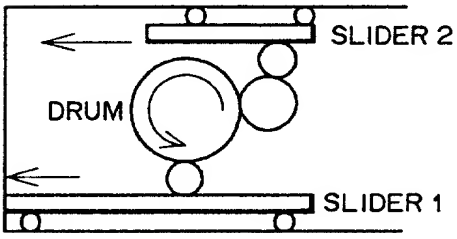


FIG.70

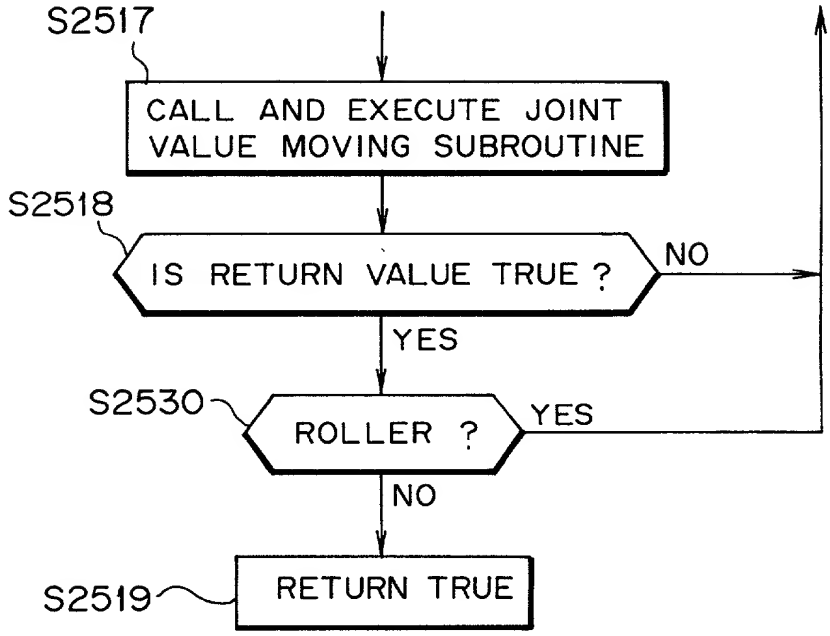

S2517
CALL AND EXECUTE JOINT VALUE MOVING SUBROUTINE
S2518
IS RETURN VALUE TRUE ?
NO
YES
S2530
ROLLER ?
YES
NO
S2519
RETURN TRUE

FIG. 71A

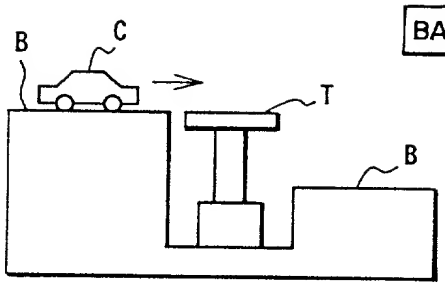


FIG. 71D

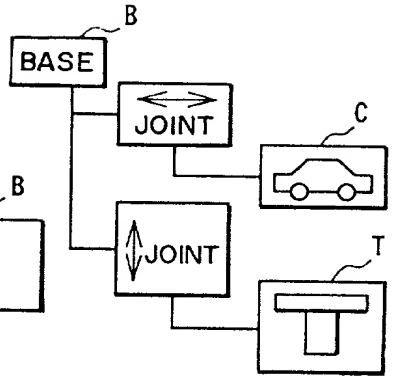


FIG. 71B

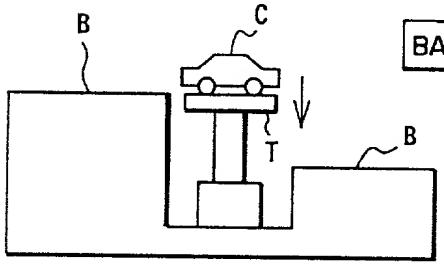


FIG. 71E

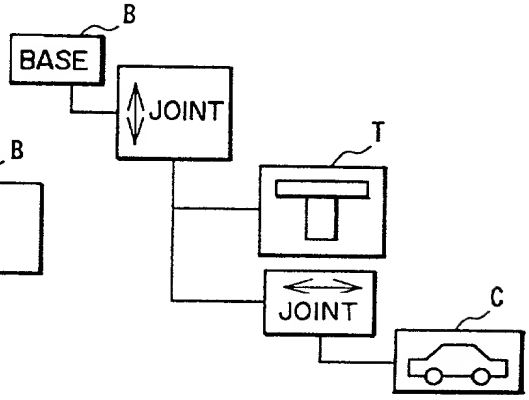


FIG. 71C

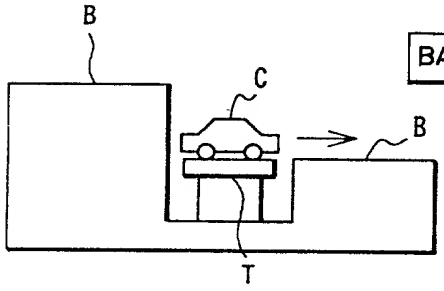


FIG. 71F

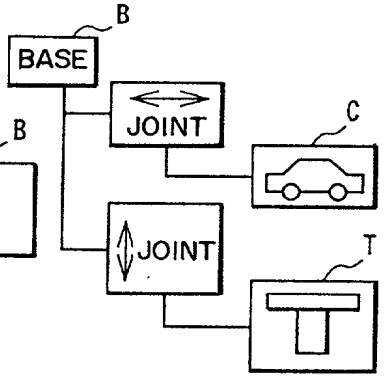


FIG.72

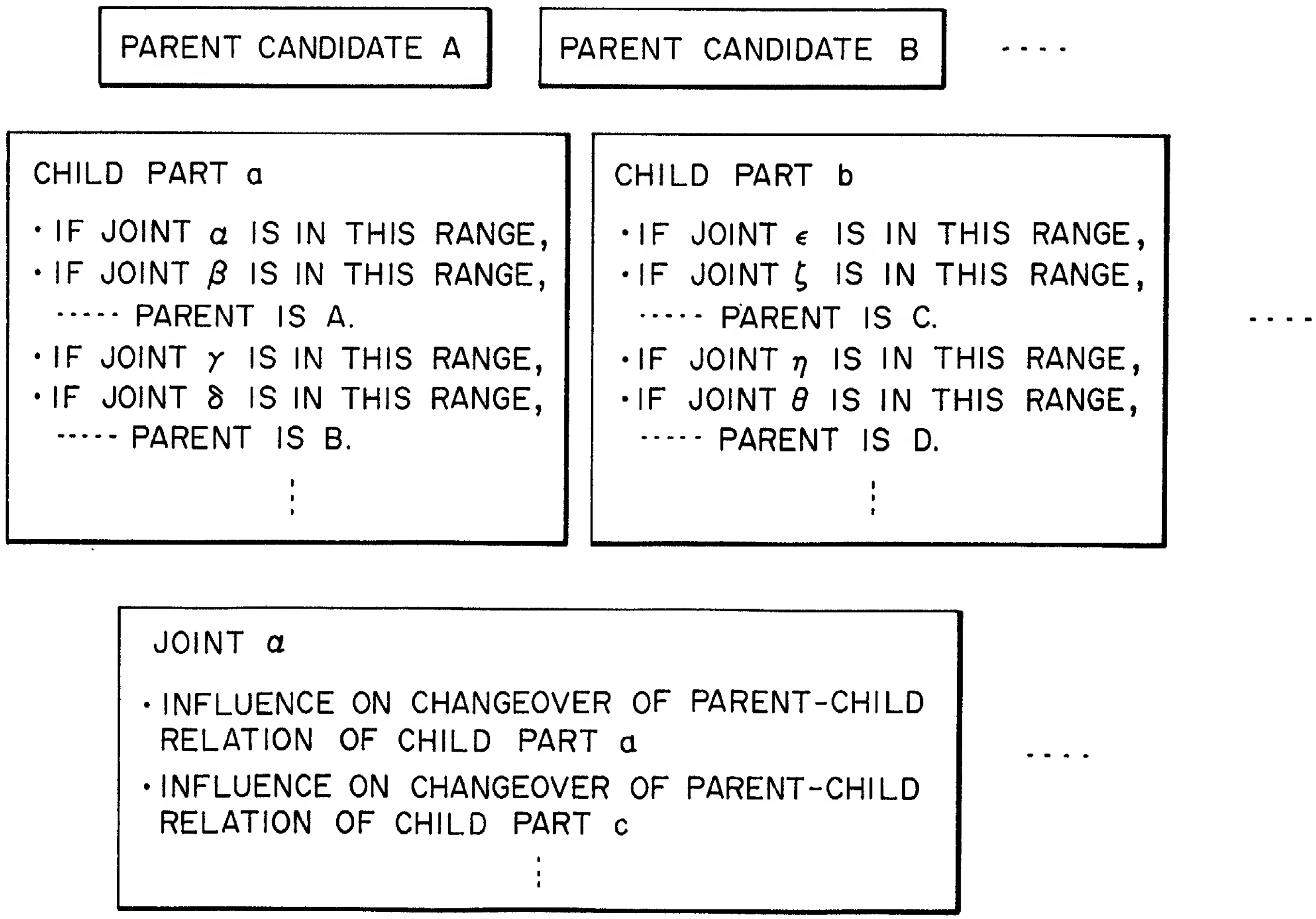

PARENT CANDIDATE A
PARENT CANDIDATE B
....
CHILD PART a
• IF JOINT α IS IN THIS RANGE,
• IF JOINT β IS IN THIS RANGE,
..... PARENT IS A.
• IF JOINT γ IS IN THIS RANGE,
• IF JOINT δ IS IN THIS RANGE,
..... PARENT IS B.
⋮
CHILD PART b
• IF JOINT ε IS IN THIS RANGE,
• IF JOINT ζ IS IN THIS RANGE,
..... PARENT IS C.
• IF JOINT η IS IN THIS RANGE,
• IF JOINT θ IS IN THIS RANGE,
..... PARENT IS D.
⋮
....
JOINT α
• INFLUENCE ON CHANGEOVER OF PARENT-CHILD RELATION OF CHILD PART a
• INFLUENCE ON CHANGEOVER OF PARENT-CHILD RELATION OF CHILD PART c
⋮
....

FIG.73

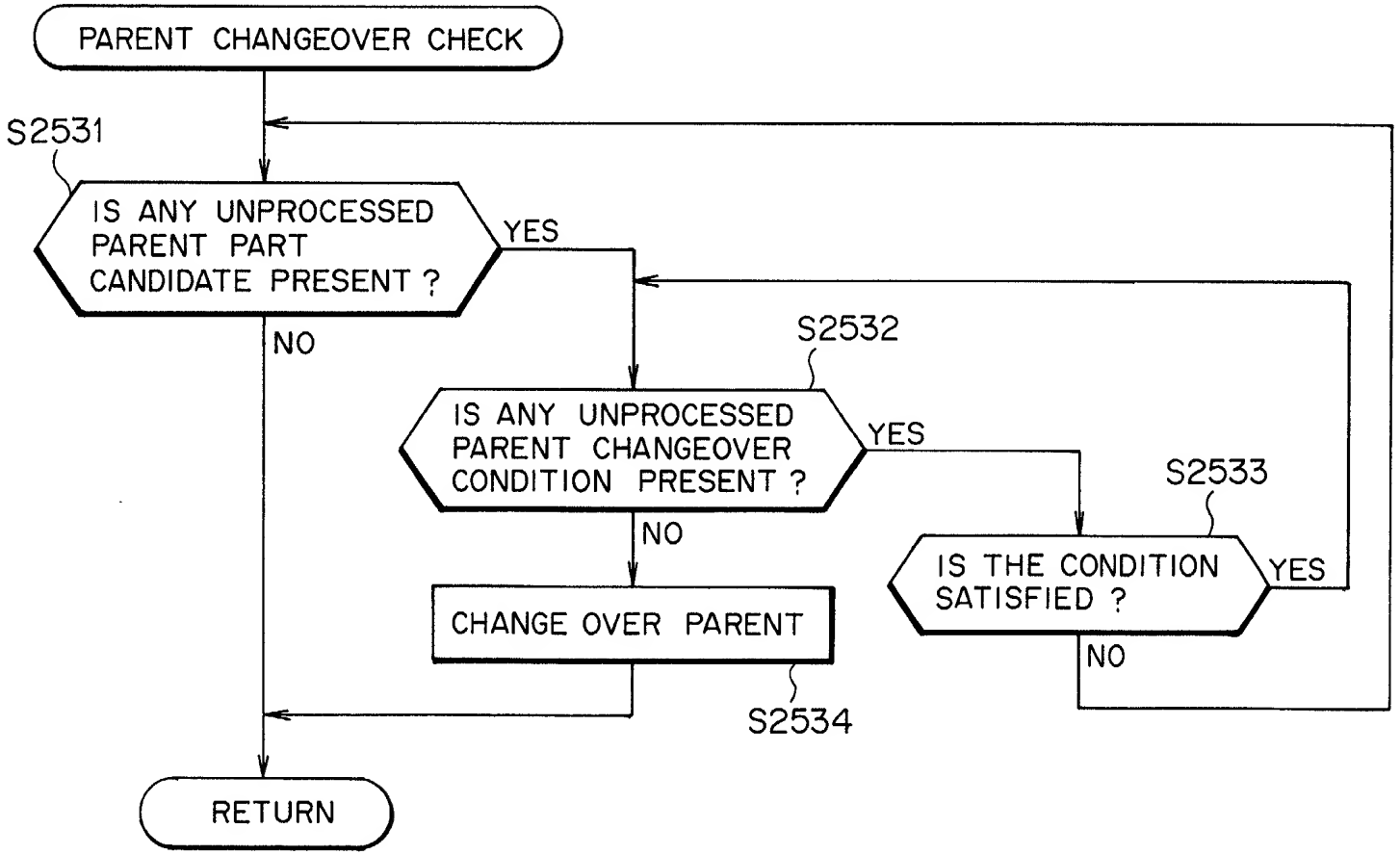


FIG. 74

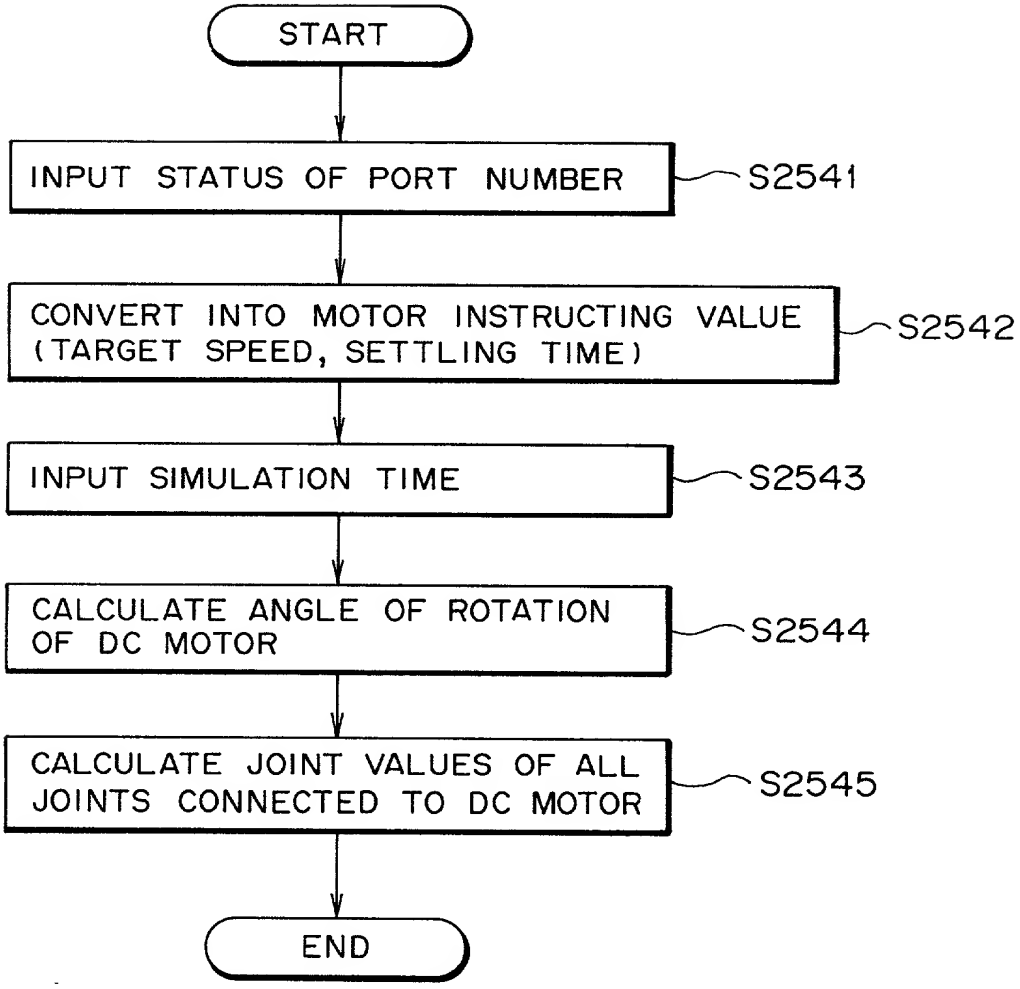

START
INPUT STATUS OF PORT NUMBER
S2541
CONVERT INTO MOTOR INSTRUCTING VALUE (TARGET SPEED, SETTLING TIME)
S2542
INPUT SIMULATION TIME
S2543
CALCULATE ANGLE OF ROTATION OF DC MOTOR
S2544
CALCULATE JOINT VALUES OF ALL JOINTS CONNECTED TO DC MOTOR
S2545
END

FIG. 75

	PORT NUMBER 11	12	TARGET SPEED [deg / s]	SETTLING TIME [ms]
MOTOR INSTRUCTIONS CORRESPONDING TO BIT STRING	0	0	0	0
	0	1	+100	500
	1	0	−100	500
	1	1	0	0

FIG. 76

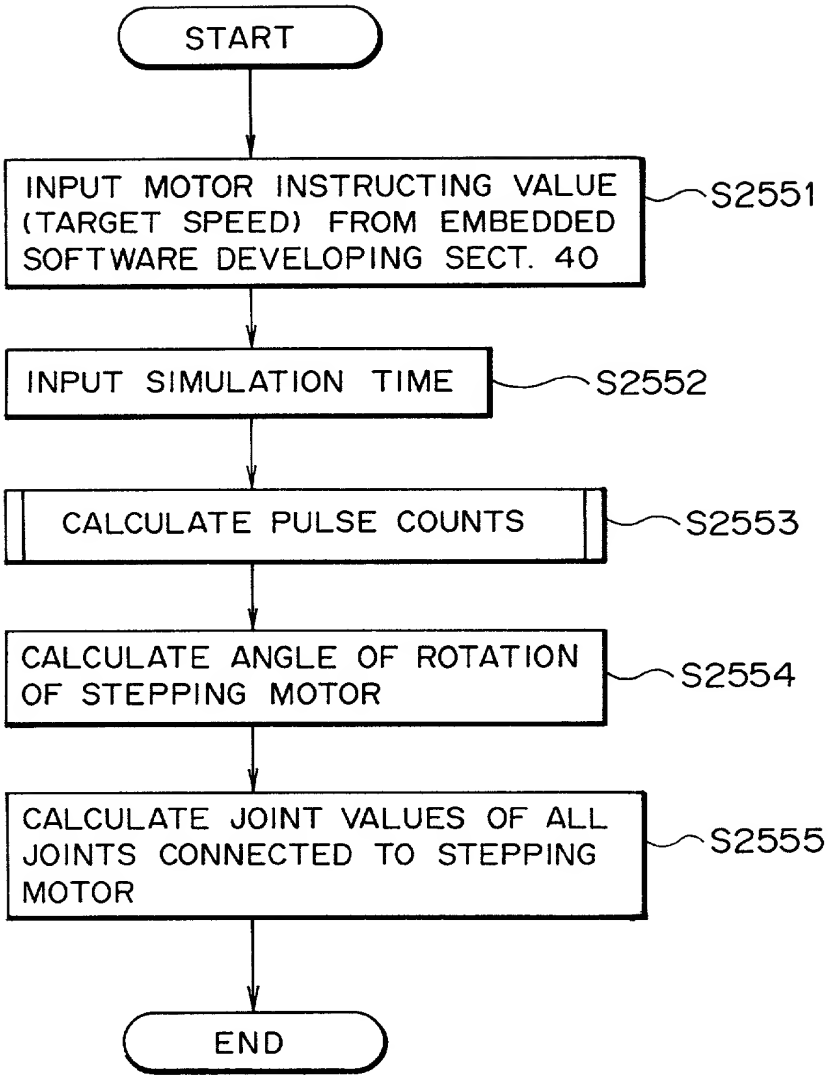
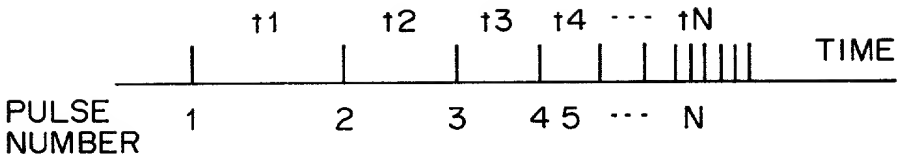

START
INPUT MOTOR INSTRUCTING VALUE (TARGET SPEED) FROM EMBEDDED SOFTWARE DEVELOPING SECT. 40
S2551
INPUT SIMULATION TIME
S2552
CALCULATE PULSE COUNTS
S2553
CALCULATE ANGLE OF ROTATION OF STEPPING MOTOR
S2554
CALCULATE JOINT VALUES OF ALL JOINTS CONNECTED TO STEPPING MOTOR
S2555
END

FIG. 77



N = NUMBER OF ACCELERATION STEPS

Th[N] = {t1, t2, t3 ··· tN}

FIG. 78

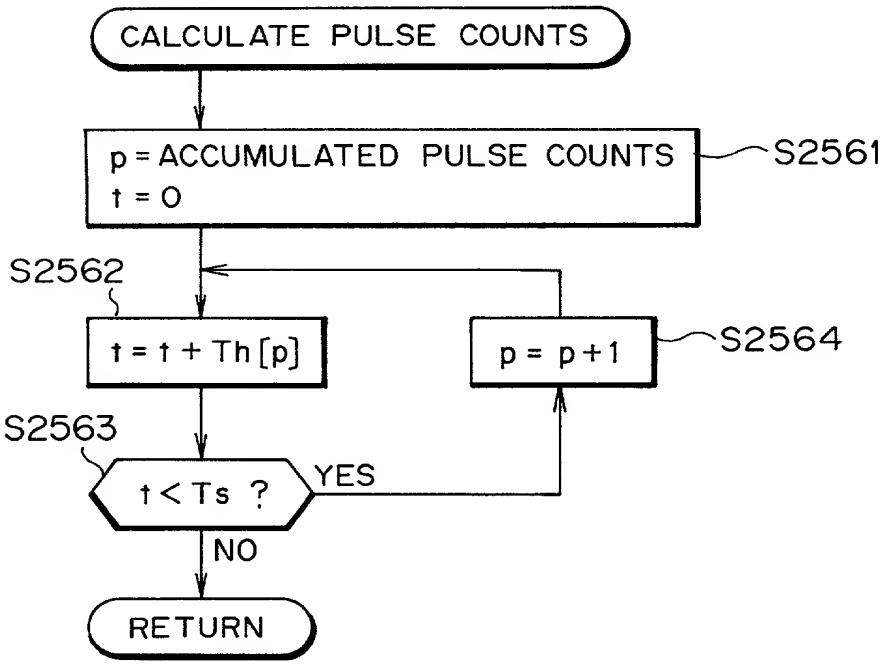


FIG. 79

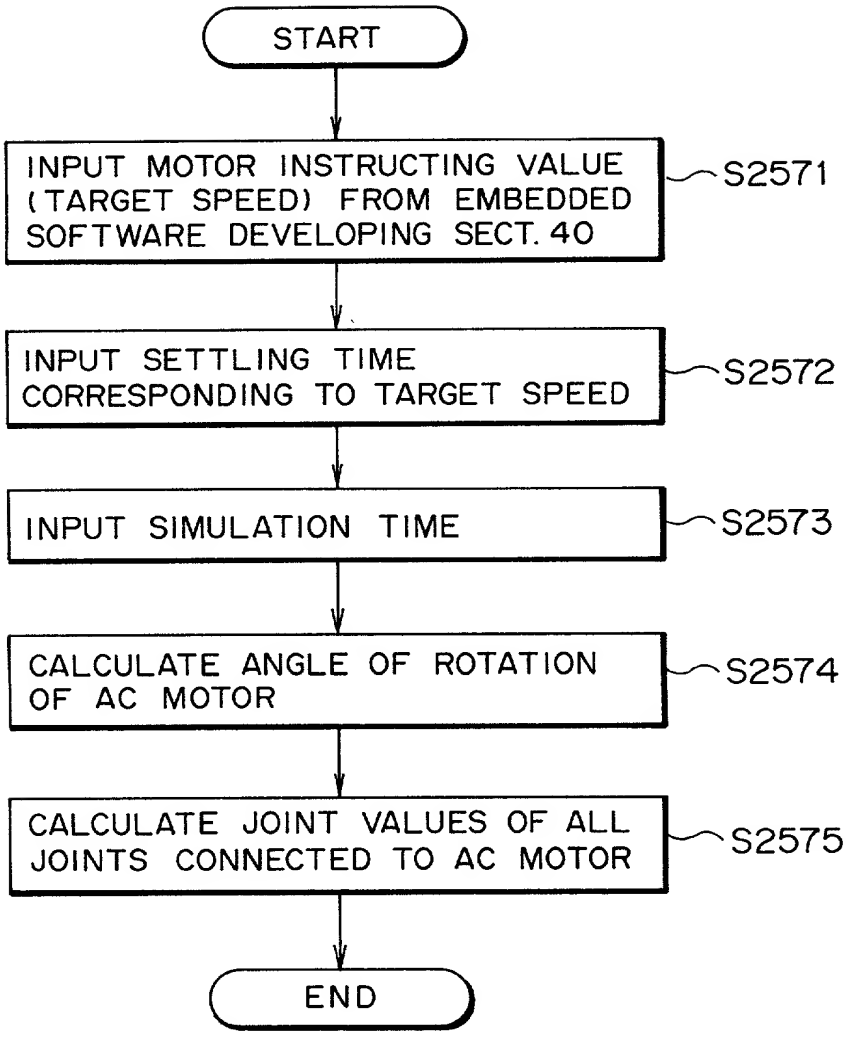

START
INPUT MOTOR INSTRUCTING VALUE (TARGET SPEED) FROM EMBEDDED SOFTWARE DEVELOPING SECT. 40
S2571
INPUT SETTLING TIME CORRESPONDING TO TARGET SPEED
S2572
INPUT SIMULATION TIME
S2573
CALCULATE ANGLE OF ROTATION OF AC MOTOR
S2574
CALCULATE JOINT VALUES OF ALL JOINTS CONNECTED TO AC MOTOR
S2575
END

FIG. 80

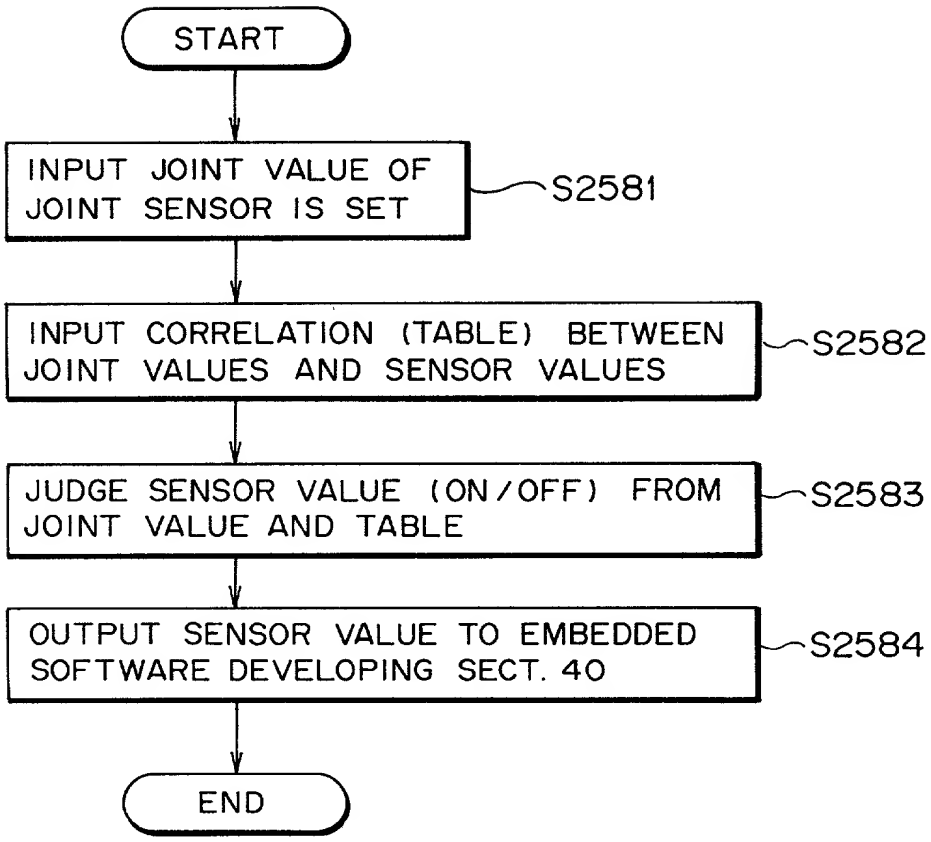

START
INPUT JOINT VALUE OF JOINT SENSOR IS SET
S2581
INPUT CORRELATION (TABLE) BETWEEN JOINT VALUES AND SENSOR VALUES
S2582
JUDGE SENSOR VALUE (ON/OFF) FROM JOINT VALUE AND TABLE
S2583
OUTPUT SENSOR VALUE TO EMBEDDED SOFTWARE DEVELOPING SECT. 40
S2584
END

FIG. 81

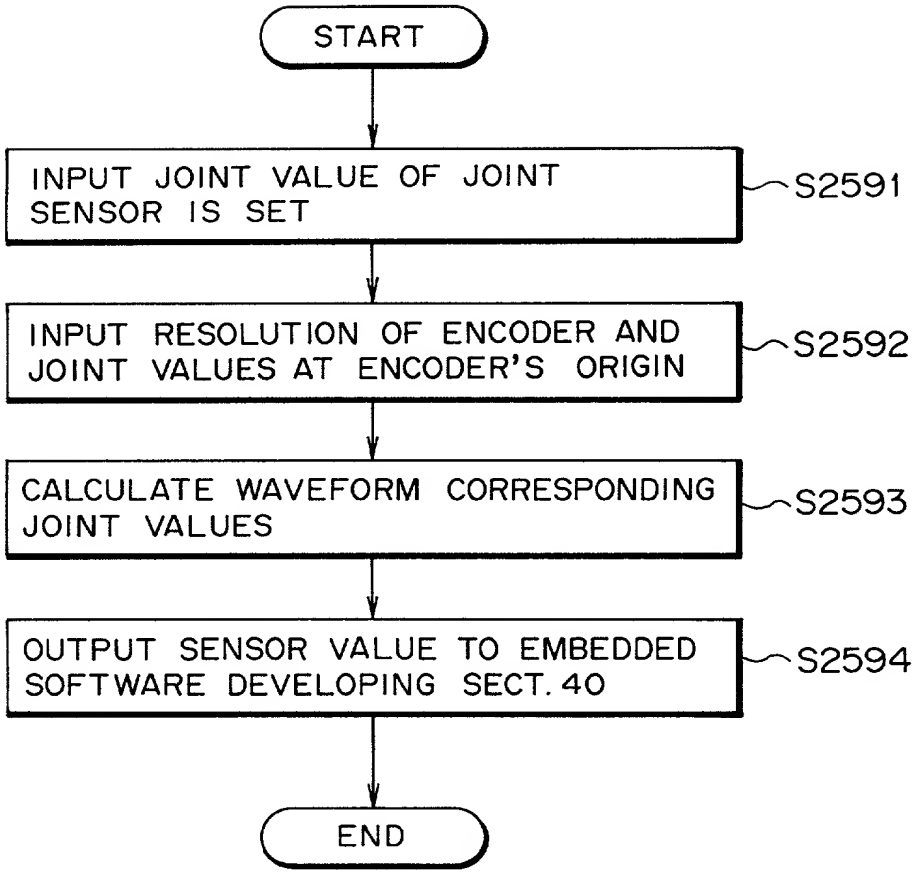
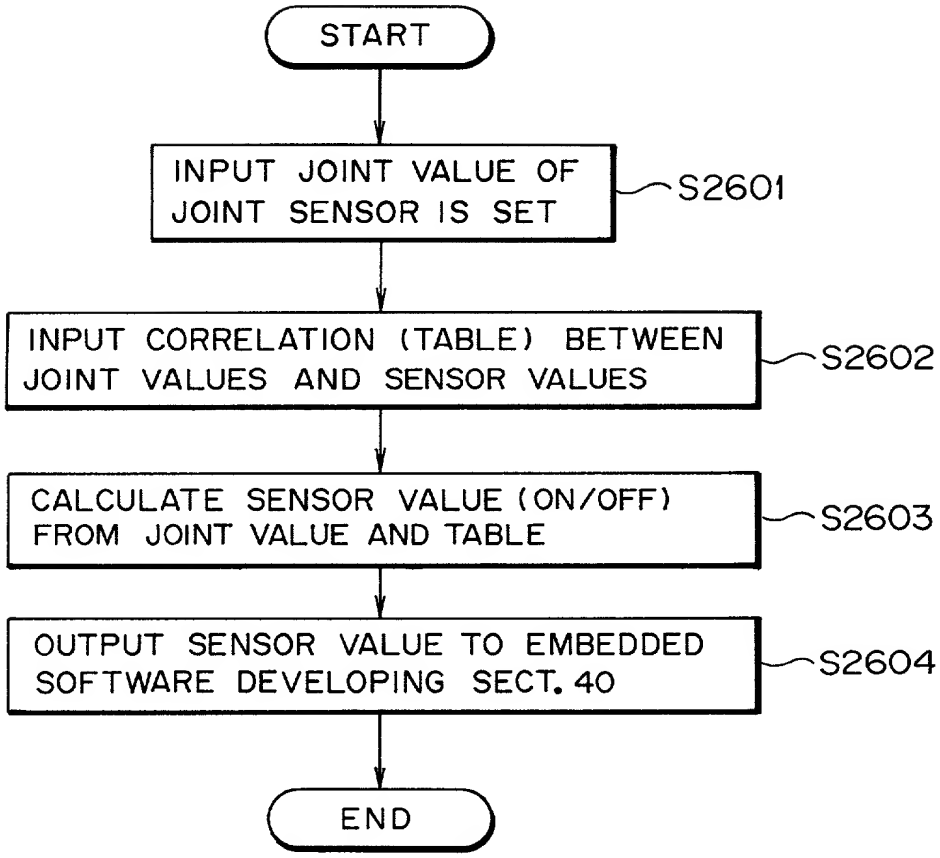

START
INPUT JOINT VALUE OF JOINT SENSOR IS SET
S2591
INPUT RESOLUTION OF ENCODER AND JOINT VALUES AT ENCODER'S ORIGIN
S2592
CALCULATE WAVEFORM CORRESPONDING JOINT VALUES
S2593
OUTPUT SENSOR VALUE TO EMBEDDED SOFTWARE DEVELOPING SECT. 40
S2594
END

FIG. 82


START
INPUT JOINT VALUE OF JOINT SENSOR IS SET
S2601
INPUT CORRELATION (TABLE) BETWEEN JOINT VALUES AND SENSOR VALUES
S2602
CALCULATE SENSOR VALUE (ON/OFF) FROM JOINT VALUE AND TABLE
S2603
OUTPUT SENSOR VALUE TO EMBEDDED SOFTWARE DEVELOPING SECT. 40
S2604
END